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A Medium of Suggestion & a Record of Progress

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Leroy A. Wilson, *President;* Carroll O. Bickelhaupt, *Sec.;* Donald R. Belcher, *Treas.*

Who's Who & What's What

in This Issue

President Leroy A. Wilson's notable statement to stockholders at the American Telephone and Telegraph Company annual meeting, which heads this issue, is the third since he took office on February 18, 1948. His election to the presidency of A. T. & T. followed by some 26 years the start of his Bell System career in the Indiana Bell Telephone Company. Two days after graduation from Rose Polytechnic Institute in Terre Haute, Indiana, in June of 1922, he reported for work as a traffic clerk and student in Indianapolis. For some years with that company he had direct charge of the telephone operating forces in several districts throughout the state before returning to Indianapolis as district traffic superintendent in 1927. Mr. Wilson transferred in 1929 to the Department of Operation and Engineering of the A. T. & T. Company in New York. His first work there was in the Traffic division, but he also gained experience in dial equipment engineering and in related fields. Ten years after his arrival in New York, he moved from the Traffic to the Commercial division of O. & E., where he was placed in charge of the work on telephone directories. The following year he was made rate engineer in the same division, and in 1942 he was appointed to head the entire Commercial division. It was from this post that Mr. Wilson was promoted to an A. T. & T. vice presidency in 1944, with the assignment to study the revenue requirements of the Bell System; and it was during this period that he contributed "Reasonable Earnings to Insure the Best Service" to the Magazine for Autumn 1945. His statements to stockholders at the last two annual meetings have appeared in these pages, as has his "A Look Around—and Ahead," which was published here last Autumn.

The talk which Oliver E. Buckley gave before the American Patent Law Association in Washington earlier this

Leroy A. Wilson

Oliver E. Buckley

W. M. Marsters

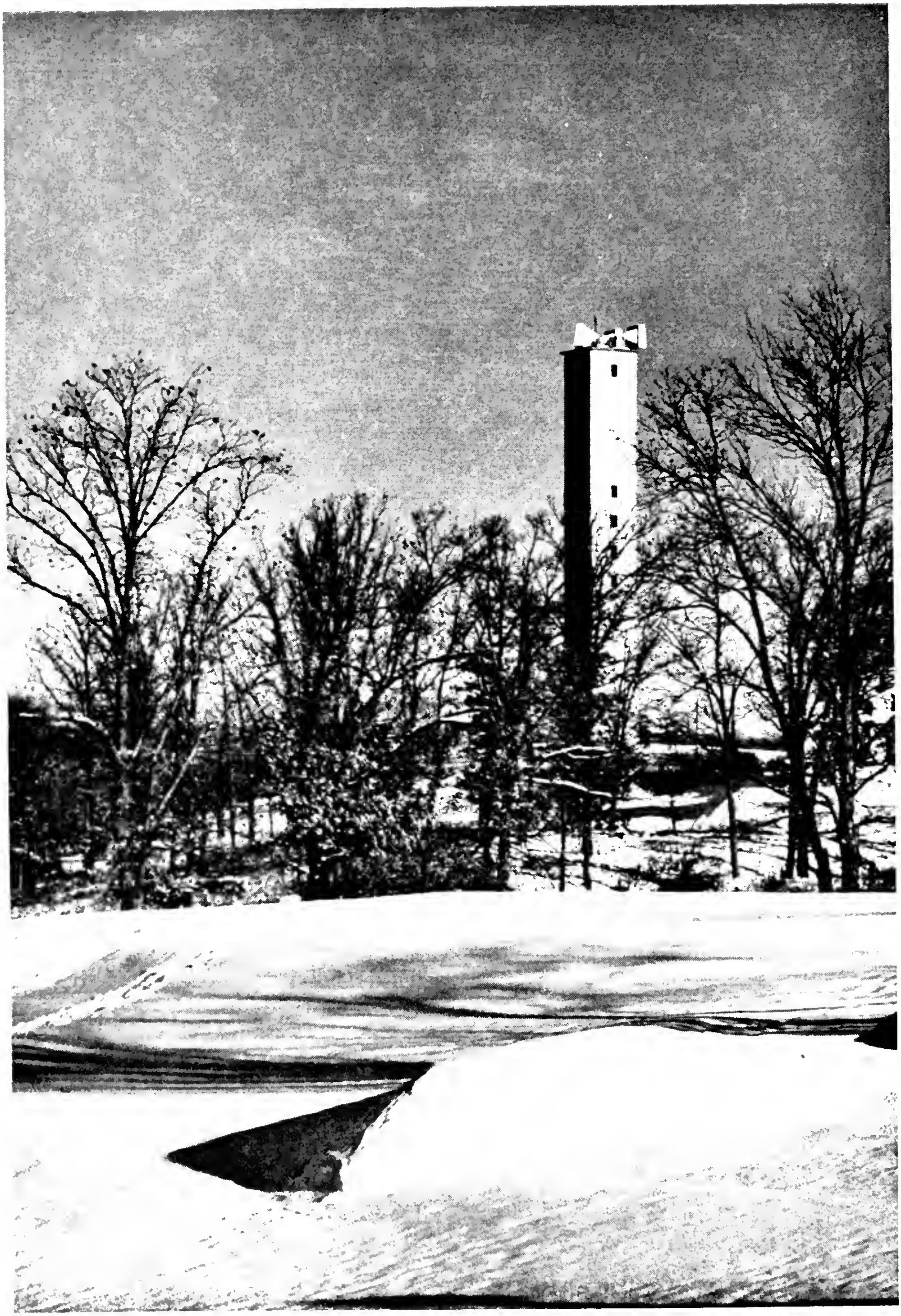
Lewis M. Fuehrer

Glen Whiteman

year was a description of selected research, inventive, and developmental activities of the Bell Telephone Laboratories. Such an exposition of scientific progress in terms of but three products inevitably reveals also something of the philosophy which motivates the work of the Laboratories, and is doubly interesting for that reason. Dr. Buckley entered the Bell System in 1914 as a research physicist. In 1927 he became assistant director of research of the Laboratories, and was made director of research in 1933. He became executive vice president three years later, and in 1940 became President of the Laboratories. During the first World War, commissioned as Major in the Signal Corps, he had charge of the Research Section of that Service in Paris. During the second World War, in addition to heading the Bell Telephone Laboratories, which made incalculable contributions to the victory of the Allied Nations, he was a member of the Communication and Guided Missiles divisions of the National Defense Research Committee. He is serving as a member of the National Inventors' Council and of the General Advisory Committee of the Atomic Energy Commission. Dr. Buckley is a fellow of several scientific and engineering societies, and is a member of the National Academy of Sciences and the American Philosophical Society. He contributed "Bell Laboratories in the War" to the Winter 1944–45 issue of this MAGAZINE, and took part in a symposium on "The Bell System's Progress in Television Networks" which was published in the Autumn 1946 issue.

THE BELL SYSTEM career of W. M. MARSTERS began with the New England Telephone and Telegraph Company in Portland, Maine, in 1910, and the ensuing 40 years have seen but two major interruptions: the first while he completed his studies, graduating in 1914; and the second, during World War I, while he served in the Office of the Chief Signal Officer, A.E.F. With Western Electric for a short time in 1914, he was one of the original telephone repeater men on the first transcontinental route, before transferring to the Long Lines Department the following year. When he returned from the Army, in 1919, he was assigned to equipment engineering work associated with the rapidly developing carrier-operated toll systems and with dial central offices. For thirty years and more his activities have expanded from that point, and he has been involved in

(*Continued on page 66*)



A new feature on the American landscape: one of the radio relay stations of the Long Lines Department of the American Telephone and Telegraph Company. This one is near Valparaiso, Ind. *See the article beginning on page 25*

In His Statement at the Annual Meeting of Stockholders Of A. T. & T., the Company's President Points Out the Post-War Gains and the Problems Which Lie Ahead

Events of Great Magnitude In Our Business

Leroy A. Wilson

In the last five years events of great magnitude and importance in our business have been taking place with remarkable speed. While all of them may be more or less familiar to most of you, I think a brief review will be helpful in making their significance more clear.

First is the tremendous post-war demand for telephone service. During these five years, the number of Bell System telephones has increased almost as much as in the first half-century of the telephone's existence.

To meet this gigantic demand, the System has been strenuously engaged in what is by far the biggest construction program in its history and the largest peace-time program of any private enterprise.

To build all the facilities needed and handle the ever larger volume of service, there has been a substantial increase in telephone employment.

At the same time, there have been steep rises in wages and also in the cost of materials. These have affected us in two ways:

First, the cost of construction per telephone has gone up so that the new plant we have had to build—and are still building—is a lot more expensive than plant built years ago. These new facilities represent nearly half of the Bell System's total plant investment today.

Second, the higher wage and material costs have likewise greatly increased the day-to-day expense of rendering telephone service.

Thus we have had to meet the problem of earning a return on a much more costly plant at the very time when expenses were going up faster than income.

Meanwhile, in order to build the facilities needed to give the service that people want, we have had to obtain a tremendous amount of new capital—more than 3½ billion dollars since the war ended. Conditions have made it necessary to obtain most of this new money by selling debt obligations. As a result, the proportion of debt in the System's total capital has gone up from less than one-third to slightly more than one-half.

All these developments have come almost on each other's heels. And the rise in costs has made necessary a further development of utmost importance—the upward repricing of telephone service. Here we are still catching up. A great deal has been done, and the recent improvement in earnings is encouraging. Our responsibility, however, is not merely to meet immediate needs but to insure the long-range financial stability of the System. I want to say a little more about that in a moment.

On the service side the Bell System people have done wonders. More than 12 million telephones have been added and the waiting list reduced to a very small proportion—about two percent—of all telephones in service. Over-all service quality is now the best ever—fast, clear, dependable, and courteous. In short, the telephone today serves more people and serves them generally better than at any time in the past.

However, we still have important service problems. While it is true that we are now meeting the great majority of requests for telephones promptly, our objective is to give service without delay to all who ask for it, and we want to meet that objective fully. Again, there are many people today on four-party lines who would like two-party service, and many more who would like to be on individual lines as soon as we can build the necessary facilities. Everyone who wants a higher grade of service than he now has ought to be accommodated, and I am glad to say that we are making steady progress in that direction.

Also during this eventful post-war period, new services, new and improved equipment, and better and more economical operating methods have been introduced and continue to come into wider use. Steady improvement of equipment and methods is essential to keep on increasing the quality of service and to keep the cost as low as possible. Technical improvements alone, however, will not today insure the long-range financial security of the Bell System. The rise in the cost of doing business has been so steep that increases in telephone rates have been and are essential. In the last ten years or so, wages alone have gone up nearly twice as much as rates, and to meet the problem additional increases in rates will be necessary.

Two things seem clear. One is that we shall continue to need additional capital to give the service the public wants. The other is that the proportion of debt in the System's total capital should be substantially reduced from the present level of about 50 percent. If we had entered the post-war period with the present proportion of debt, it is difficult to see how we could have met service demands as we have. We should be equally well prepared for any contingencies in the future.

It follows, therefore, that most of the new money required should come from issuing stock, either through conversion of debentures or otherwise. It likewise follows that earnings must be adequate to make the Company's stock attractive to new owners, and that these earnings continue to be sufficient, as additional shares are issued, to insure a stable return and protect the investment of existing stockholders and new stockholders as well. This is the foundation of everything we are trying to do, and it is just as important to telephone customers and employees as it is to the stockholders—for investors' money is essential to give customers the service they want, good service is essential to win customers and thereby maintain good jobs for employees, and good earnings are essential to attract and protect the savings of investors.

In stressing the importance of a stable return, I am aware that I have not touched on the decline in the real value of the dollars in which the return has been paid over a period of many years. This problem exists throughout our whole economy, and is most certainly a matter for grave concern. Its solution, if there is to be one, must I think depend on economic forces affecting the entire nation. But in the meantime, when the dollars of our dividend buy less, we must be doubly sure that the stockholder gets at least the full number of dollars.

A word about taxes: We think the telephone is paying more than its fair share. For the average Bell System telephone, the total tax load is over $2 a month. More than half of this amount is in excise taxes applied at very high rates. I know of no other service of like necessity that bears a comparable burden.

As already mentioned, wage increases in the Bell Telephone Companies in the last ten years total about twice as much annually as the increases authorized in telephone rates. It is also a fact that present wages average about double what they were ten years ago. Bell System wage policy is to pay wages that compare favorably with those paid for similar skills by other concerns in the communities where the Bell Companies operate. To do less would assuredly be bad for telephone serv-

President Leroy A. Wilson extended cordial greetings to many stockholders at the annual meeting of the American Telephone and Telegraph Company held on April 19, 1950

A display of many items of communication equipment had been set up in a room adjoining the assembly room in which the annual meeting took place, and was a point of interest to numbers of stockholders

ice, for in order to give good service it is necessary to attract and keep competent people. On the other hand, payment of unduly high wages would be unfair to telephone customers who pay the bill.

Telephone wages have gone up much faster than the cost of living during the war and post-war period. There are other factors in telephone employment, too, that are extremely advantageous. The Bell Companies have been pioneers and are leaders today in their Benefit and Pension Plans. Telephone work is generally steady work, and this is an up-from-the-ranks business with unusual opportunities for advancement. In fact, for every five employees in the Telephone Companies, there are more than two promotions to better jobs at higher pay in an average five-year period.

Present contracts between the various Companies and the unions provide for higher wage payments in the coming year for the large majority of all non-management employees. Nevertheless, many of the unions have made heavy additional demands, and the leaders of the Communications Workers of America (CIO), whose divisions represent about half of all employees of Bell Companies who are represented by unions, have threatened a strike on April 25 unless agreements satisfactory to them are reached.

I hardly need to say that the Companies concerned are intent on doing everything they properly can to avoid any interruption of telephone

Teletypewriter service in operation—"the written word by telephone"—was a feature of the display. Here it is being explained to A. T. & T. Directors James F. Bell and Vannevar Bush

service. They are also keenly aware that they should be fair not only to their employees but equally fair to telephone users who pay the bill. The importance of this becomes all the more clear when it is remembered that further wage increases would immediately call for additional rate increases beyond those already authorized and pending, and also beyond those which must still be applied for to meet past rises in costs.

The Companies have carefully checked their wages with the wages paid by others in the areas they serve, and have found that telephone wages and over-all working conditions compare extremely well with outside industry. The Companies have also asked the unions to present factual data in support of their further demands, but little has been forthcoming in that respect.

I wish I could tell you what the outcome will be, but only time will tell. I am however sure of these things:

First, as the President of one of the Associated Companies recently expressed it, "The Company wants good pay and good working conditions for its employees. Our management has no incentive to pay less than other employers for the skills necessary to furnish our high quality of service."

Second, the Companies feel an obligation not to pay wages that would place an undue burden on telephone users.

Third, the managements in all the Companies engaged in bargaining, who came up from the ranks themselves, will be zealous in maintaining wages and working conditions that are fair to all concerned.

In conclusion, I have one further thought that I would like to leave with you. Clearly we have had a great many serious and difficult problems to meet in the last few years, and there is no doubt that the same will be true in the future. These problems are of all kinds—service problems, technical problems, expense problems, wage problems, rate problems, employment problems, financing problems, and almost every other kind of problem that can be imagined. The success of the business depends on meeting every single one of these problems and meeting all of them wisely and well. Nothing less will do. It goes without saying that this demands the utmost acceptance of responsibility by management, complete devotion to the best interests of the business as a whole, and the capacity and willingness to exercise leadership no matter what obstacles must be overcome. This is true today in our business just as it is true in every other phase of our national life.

It seems to me, therefore, that there is one other problem even more important than those I have just mentioned. That is to find, develop, and hold the future leaders who can be depended on to manage this business well and guide it to greater achievement in the years that lie ahead. This is an absolutely essential part of your present management's obligation to carry this enterprise firmly forward. It is the key to success in the long run, for no business succeeds without good management and good management does not just happen. It has to be selected, developed, and encouraged. Nothing will help more—nothing will better serve to attract the leaders we shall need in the future—than the encouragement and support that you stockholders give to management efforts.

So I urge you to make that kind of contribution to the future of your business. I assure you that it can and will give incentive and inspiration to those on whom you must depend to manage the business well not just today and tomorrow but for years and years to come. And I assure you also that by so doing, you as stockholders can each take a personal part in making more valuable to this nation the essential service rendered by the Bell System.

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An index to Volume XXVIII (1949) of the Bell Telephone Magazine may be obtained without charge upon request to the Information Department, American Telephone and Telegraph Company, 195 Broadway, New York 7, N. Y.

Mindful of Its Responsibility

An announcement on the "Telephone Hour" radio program of January 30, 1950

VERY OFTEN on this program we have talked about the responsibility the Bell System has for providing an ever-improving telephone service to the people of America.

We have also spoken of the responsibility that management has for paying a fair return on the investments of the hundreds of thousands of people whose savings have built our telephone system.

Our business also has a responsibility to the employees, and tonight we'd like to tell you a little about that part of our job. First, the business must pay good wages, wages that compare favorably with those paid others in the community for comparable skill and experience. Holidays and vacations should be provided for, as well as sickness benefits and pensions on retirement.

Merit should be recognized and opportunity provided for advancement, and there must be the kind of satisfaction with the job that comes from good working conditions, thorough training and knowledge of the business. The record shows that telephone people enjoy all these things to a high degree. They have steady year-round employment. They are among the best paid industrial groups in the nation.

Recent U. S. Department of Labor reports show that telephone line construction, installation and maintenance employees rank ninth among more than 200 separate industries. These reports also show that the girls on the switchboard are well above the average of the white collar workers with whom they compare.

Telephone Company employees are protected by a well-rounded benefit and pension plan. It helps them in meeting emergencies that may come with sickness, injury or death. It provides for both service and disability pensions. The Company pays all the costs.

One of the reasons the Bell Telephone System has been able to meet its responsibility to the users of the service and to the investors is that it has been mindful of it responsibility to those who spend their working lives in the business. All this adds up to why your telephone service is better today in most respects than ever before and will keep right on improving in the future.

The Forward March of Service

Excerpts from President Leroy A. Wilson's New Year's message to the members of the Bell Telephone Laboratories form an appropriate introduction to the address by the head of those Laboratories which begins on the opposite page. EDITOR.

TELEPHONE SERVICE begins with technology, and continuously through the years it has been the widening of technical horizons that has made possible the expansion and improvement of the service. The greater the range and usefulness of the service, the more extensive and intricate our technical knowledge and physical equipment have first had to be. But I would emphasize that although technology must come before the service, the service *idea* comes before the technology . . .

As we approach the mid-point of the Twentieth Century it is interesting to look back and see how telephone science and telephone service have advanced hand in hand in the years since the century began. To recall just a few of many outstanding developments within this period, we may think of the telephone repeater and the establishment of transcontinental service; the advance in radiotelephony and the creation of world-wide overseas service; the inauguration and development of fast, accurate dial service, with more than 70 percent of all Bell telephones now on a dial basis; and the origination and extension of carrier telephony, making possible the economical handling of vast numbers of toll and long distance calls.

Coming down to more recent years . . . new toll switching systems have opened up the field for long distance dialing, both by operators and by telephone users, and direct nation-wide dialing in the years ahead will help to revolutionize our conception of how good telephone service can be. Broad band radio relay and coaxial systems, already carrying television images as well as telephone conversations, provide the means for transmitting intelligence on an entirely new scale. Automatic message accounting makes a tremendous contribution to service both in the direct dialing of telephone connections and on the accounting side. New instruments, new materials in outside plant, new tools for construction and maintenance—all are aimed at . . . the rendering of the best and most economical telephone service to the American people that it is possible for us to provide. . . . The needs and opportunities are very large—not only in the long-term future, but also in the years immediately before us. I am confident that telephone science, animated as it always has been by the service idea, will continue to enable us to make telephone communication always better, more extensive, and more valuable tomorrow than it is today. And I am confident also that in Bell Telephone Laboratories we shall continue to have the people, the skills, the organization and above all the inspiration to accomplish that end.

The Interrelation of Research, Invention, and Development In the Work of the Bell Telephone Laboratories Is Here Discussed by Their President

Some Observations on Industrial Research

Oliver E. Buckley

[*An address before the American Patent Law Association in Washington, D. C., March 6, 1950*]

IN A BRIEF TALK on the broad subject of industrial research, it is obviously impossible to be comprehensive. I have therefore chosen a title that would give me considerable latitude, and in discussing industrial research I shall limit myself to only a few of its many aspects. My own enthusiasm for the subject is not based primarily on generalities but on particularities, so I have elected to discuss a few specific developments to which research has contributed significantly and in different ways, and in which invention has played an important part.

From a great number of research products on which we have worked in Bell Laboratories, I have selected only three: the telephone receiver, electron tubes for microwave radio, and a newly invented device called the transistor.

Research on the telephone receiver dates back to Alexander Graham Bell, and has been continuous since the birth of telephony.

Microwave radio is of later development, and only in recent years has it been put to practical use.

The transistor is in its infancy, but has a promising future.

All three subjects represent a diversity in other and obvious respects. They are, however, alike in being very important in attaining the high quality and low cost that is one of the major objectives of telephone research. In the work that has been carried on in these three developments, moreover, there are certain features common to all of them that I should like to point out later.

The Telephone Receiver

The telephone receiver is a small and simple device. In fundamental principle, the receiver that forms part of the telephone on your desk today is like that devised by Mr. Bell within the first year of telephone history—and a remarkable year of achievement that was. Over the course of the years, other principles have been incorporated as advances have been made, not steadily but in jumps, and the most radical advance in all the seventy-five years of telephone receiver history has been incorporated in the latest design of telephone instrument just recently announced.

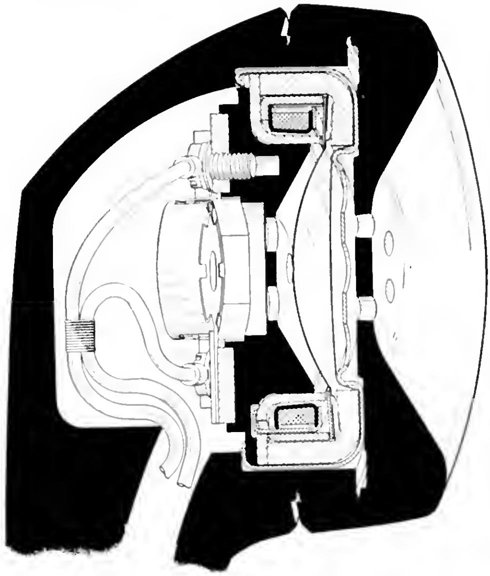
Looking back over those years of telephone receiver development following Bell's original telephone, we see that they break into two epochs: in the first, design changes were made by applying the best thought of engineers and designers to improving the performance of a device without departing from accepted fundamental principles; and in the second, all such restrictions were thrown aside, and an investigation was launched to find, for purposes of research, how a receiver might be designed to achieve perfection of performance independently of its cost or its suitability for practical use. Only by achieving actual perfection in a laboratory model

Left: Early telephones, shown at the top in perspective view of 75 years of telephone development, had no separate listening device: mouth and ear were applied alternately to a combined transmitter-receiver. The new receiver discussed in the adjoining columns is part of the latest type of telephone, now on trial, which is pictured at the bottom of the illustration could we get a sound measure of practical compromise between cost and performance in the commercial product.

This undertaking was begun about 1915. The essentially perfect performance sought was achieved in the late 1920's. We built in the laboratory a system which would convey speech from one person to another as effectively as if one spoke directly to the other close by. This system then served as a reference for judging the performance of commercial telephone apparatus. Since then we have been driving at narrowing the difference between the practically achievable product of the factory and the ideal of perfection toward which we strive. We have made great gains, as all of you know. These gains have come out of organized research along several lines, two of which I want especially to describe.

Right after the first World War, we undertook research on submarine telegraph cables which led to enhanced interest in magnetic materials of high initial permeability to make feasible the inductive loading of ocean cables and thus an improvement in telegraph speed. A nickel-iron alloy had been discovered and a heat treatment devised which led to a solution of this problem. Other uses for such alloys were sought and found, and a greatly expanded investigation of magnetic alloys was undertaken. Fundamental understanding of the process of magnetization was lacking, and so we endeavored to find out why a combination of nickel and iron was so much better than either of them alone.

At the same time, we pursued a



A perspective cross-section of the new receiver, showing the ring-type coil and the dome diaphragm

cut-and-try procedure and mixed up hundreds of combinations of nickel, iron, cobalt, and other elements, and subjected them to a variety of heat treatments. Early returns came from this strictly empirical type of research, as often happens.

We are still working on the fundamental research which at first trailed the cut-and-try method but later pointed the way to further improvement.

As magnetic research went on, new materials were developed with ever better properties: materials, for example, that were a hundred times easier to magnetize than is iron, and others very hard to de-magnetize that made excellent permanent magnets. Out of this work came materials designed to have qualities especially desirable for many applications in our business; among them was the telephone receiver. Three different alloys were developed to meet the special needs of this instrument—a nickel-iron alloy for the pole-pieces, an iron-cobalt-vanadium alloy for the diaphragm, and an iron-cobalt-molybdenum alloy for the permanent magnet. These alloys make possible light weight and high efficiency, and they also have mechanical properties suitable for economical manufacture.

ANOTHER line of research also contributed to this development. Again it relates to inductive loading, for it was his method of solving the problem of loading telephone lines that led Dr. George Campbell to invent the electric wave filter,* so important in all communication engineering today. A whole new technology of alternating current network analysis grew out of the original work on the filter, and in the course of time engineers began to apply this analysis to mechanical systems. A telephone receiver could thus be regarded as an electric wave filter made partly of electrical, partly of mechanical, and partly of acoustical elements, and an electrical network could be made to simulate its action. Indeed, the telephone receiver of earlier times was a wave filter that left room for improvement. Its resonant diaphragm made it much louder at certain frequencies than at others, and was responsible for its distortion of speech sounds.

To get rid of this distortion, it was necessary to insert resistance in a manner calculated to make the receiver pass all frequencies alike. This was accomplished by devising a chamber within the receiver so that air is pumped in and out of an orifice as the diaphragm vibrates. At the same time, the air in this chamber adds other elements of mass and stiffness, and thus the equivalent network becomes more complex. Indeed the air cavity between the receiver and the ear of the user plays a measurable part in performance. It is, however, all capable of calculation if exact measurements of the properties of individual elements are at hand. It was on this basis that the present standard telephone receiver was designed. Its high efficiency and light weight have been made possible by improved magnetic materials, and its low distortion by analytical design based on precise measurement.

We are not satisfied with it, however, and have found a way to make even a better one, which is incorporated in the newest model telephone instruments now undergoing trial. In this new receiver, a lighter diaphragm made of a flat ring carrying an impregnated fiber dome gives better coupling with the air. A ring-shaped coil, and ring-shaped magnet and pole-piece, actuate the diaphragm. The whole structure is both lighter and more efficient than its predecessor.

ONE FURTHER FACTOR figured significantly in its development. To achieve our ends, it was necessary to develop new methods of rapid and precise measurement. A whole new art of acoustical measurement has been achieved over the past thirty years, and this new art has led to advances in other fields as well.

The telephone receiver which has evolved is not, of course, a single in-

* An electric circuit capable of passing or rejecting groups of frequencies at the will of the designer.

vention but has drawn upon many inventions in materials and in structures. Systematic research in magnetics, acoustics, and electrical networks gave a foundation in knowledge and understanding. Precise measurement gave a basis for systematic design. A well defined goal gave an objective. Ideas for achieving that goal came out of the minds of inventors. Research and invention had to be followed by development to give a reliable, reproducible, long-lived device that could be made economically and to precise specifications. Thus were combined the knowledge and skills of physicists, chemists, metallurgists, mathematicians, and engineers. Among them were inventors who were bold in questioning whether the others were on the right track, and in proposing new ways to reach the goal.

Thus the course of research to improve telephone receivers is marked by development of new materials, the application of analytical methods, the transfer of a method of thought from one art to another, the use of rapid and precise measurement, and—most of all—by setting a well defined goal of perfection.

Electron Tubes for Microwave Radio

THE FIELD of microwave radio transmission is another in which measurement techniques and analytical procedures have figured prominently.

The advance of radio communication has been marked by the extension of the usable radio spectrum to higher and higher frequencies, and as the frequency limit has been pushed up, new problems of ever increasing difficulty have been encountered. New tools of measurement have had to be devised for every step.

These tools were our first undertaking when in 1930 we began working in the hitherto unexploited region of thousands of megacycles. We were interested in the application of those frequencies both to radio relay systems which we then envisioned and for transmission through pipes or wave guides.

The soundness of that approach has been demonstrated by the great advances which have followed, but its importance proved far greater than anyone could have anticipated, for these tools of measurement were at hand and proved invaluable when the war came along and microwave radar was developed. Without those tools, some of the great accomplishments of radar could not have been achieved in as short time as they were.

The utilization of very high frequencies for communication has been dependent in great degree on the availability of amplifiers. The ordinary vacuum tube amplifier, such as is used in the radio broadcast art, starts falling off in amplifying efficiency at frequencies well below 100 megacycles per second. Two factors are principally responsible: one, extra capacitance * between electrodes of the tube; and the other, the time required for electrons to travel from the negative to the positive electrode of the tube.

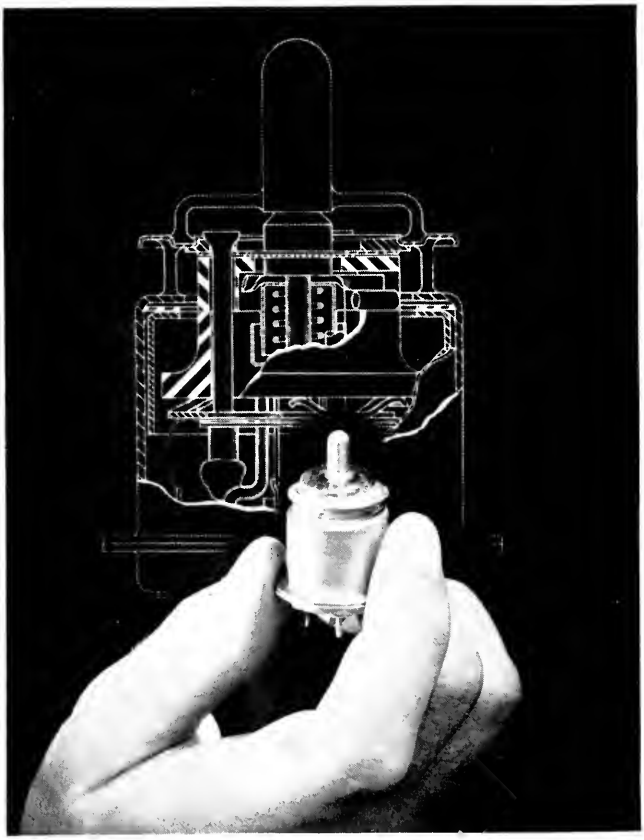
To overcome these obstacles has been an objective in almost every research group in this highly competi-

* One of the factors that affects the amount of current that will flow in a circuit.

tive field. As research has added to understanding, and as invention has produced new devices for getting around obstacles, the frequency range available for communication has been pushed to the region of billions of cycles where formerly it was limited to millions.

Figuring prominently in this advance have been three essentially different types of amplifying devices—the klystron, the traveling-wave tube, and the ordinary triode modified in form. The klystron has found considerable use in communication at very high frequencies, but the band width of frequencies it can amplify is limited by resonance effects. The traveling-wave tube provides an escape from this limitation, and the highest frequency at which currents have been amplified to date has been reached with a traveling-wave tube working at 48,000 megacycles—with waves only a quarter of an inch long. We can expect it to go even higher.

Many radical new schemes for amplifying at high frequencies have grown out of the traveling-wave concept. Among them are tubes in which two electron streams are used, one working on the other, and tubes which combine the features of the traveling-wave tube with those of the magnetron used for generating radar pulses. Indeed, this is an area of research that is probably unsurpassed in activity, and inventions are appearing from many parts of the world.



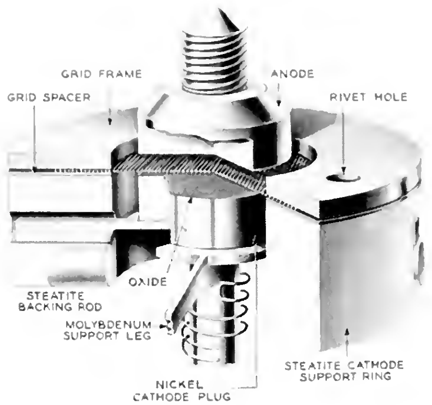
A close-spaced triode tube is shown against an enlarged cross-section drawing of it

It is, however, about the simplest type of electron tube, the triode, that I want principally to talk, both because of its simplicity and because it illustrates the contribution of persistent research and clever inventiveness to improving the capabilities of an existing device by going to extremes without introducing new fundamental principles of operation.

This little tube, about the size of an English walnut, is at the heart of the repeater used in new radio relay systems, such as that now being installed between New York and Chicago. Small as it is, this tube can handle enough power to send a beam of radio waves from one tower to the next, usually about thirty miles away. Better yet, it can handle a broad band of frequencies, so that the beam can carry many hundreds of telephone channels and television as well.

A tube for a radio relay system that is to span the continent has to be a very reliable device, for a hundred relay stations, each using a number of tubes, must work in tandem, and the failure of only one tube may cause an interruption. Further, even the very small distortion that may occur in a single amplifier can build up into serious distortion in a long succession of amplifiers. These were some of the considerations that led to developing the simple triode into a device to work at frequencies above 4000 megacycles.

Though having the same fundamental elements as the original deForest audion—a filament, grid, and plate—this tube is radically different in structure and shape. The electron-emitting filament has become a flat surface ground to great precision. That surface has been coated with materials to facilitate release of electrons in number far greater than was once thought possible.* This makes it possible to get the power output we need, and at the same time retain a small area and correspondingly small capacitance between electrodes.



Here is a cut-away drawing showing the active elements of the close-spaced triode tube

The grid is still a structure of wires stretched in a plane, but what different wires they are! Unless your eyes are better than mine, you could not see them without a magnifying glass. They are only three ten-thousandths of an inch in diameter—about a fifth the diameter of a fine human hair—and are held in place with a precision consistent with that size. The spacing between grid and cathode is only six ten-thousandths of an inch, and it must remain closely fixed as the tube is heated and cooled. The anode,† or plate, has become part of a resonant cavity to reduce capacitance effects, and its dimensions are as accurately held as are other parts of the tube.

Indeed, this tube has a precision unapproached by its predecessors and, for that matter, equalled by few mechanical devices. It would be wrong, however, to assume that this

* In this tube, we get nearly two-tenths of an ampere of electrons per square centimeter.

† The anode is the positive electrode of a tube, while the cathode is the negative electrode.

One of the air-conditioned rooms at the Bell Telephone Laboratories where parts of the close-spaced triode tube used in radio relay systems were assembled during the development period

was an instance of straightforward engineering that anyone skilled in the art of vacuum tube design and construction could do. To achieve the result which this seemingly simple device represents, there has been applied knowledge growing out of years of research in wave guides, network theory, thermionics, electron dynamics, and even theory of quality control. Added to this essential theoretical background were the products of research in metals, ceramics, soldering compounds, glass-to-metal bonds, and the chemistry of getting the surfaces of these materials atomically clean. New inventions had to be forthcoming to make it possible to build the tube. A new method of making coated cathodes had to be devised, a special machine had to be invented to wind the grid with the required uniformity, a new ceramic seal had to be invented, as did also an entirely new method of assembly. These steps were not the obvious ones to take, but came from original ideas, from invention, and from the capacity for taking infinite pains.

A New Device: the Transistor

My THIRD and last topic is the transistor. It is a device for amplifying electric currents, and so is a competitor of the amplifying vacuum tube, but, unlike it, has no vacuum, nor does it have a hot cathode. In structure it

Two of the transistors which are currently under development at the Bell Laboratories as amplifying devices

is a very simple thing, consisting only of a tiny germanium crystal with a couple of metallic points close together pressing on it. Current through one point to the crystal influences current through the other point from the crystal.

The transistor is such a simple device that one may well wonder why it was not discovered by cut-and-try experiments. Many experimenters had had the idea that a solid-state amplifier should be a practical possibility, but all of their attempts to make one had failed. It was not for lack of trying that such an amplifier was not invented earlier, but for lack of understanding.

The transistor is as much a product of invention as was the vacuum tube amplifier; but in the absence of knowledge of just what goes on at the contact of a metal point with the surface of a semi-conductor, no one had the basis for conceiving how to make an amplifier from a germanium crystal with a couple of metallic points pressing on it. It was to get an understanding, and with a confidence that something useful would come out of it, that a systematic research on the properties of semi-conductors was organized.

Semi-conductors are those materials in the solid state intermediate in conductivity between metals and insulators. Silicon and germanium are two such materials. We had a spe-

Set beside an ordinary paper clip, this sectionalized transistor reveals its diminutive size

cial interest in them because of applications we were making of these materials in certain control devices and in rectifiers for very high frequencies.

One of the characteristics of germanium, and also of silicon, is that it may exist in either of two states depending on the presence of minute impurities. In one of these states a metallic point in contact with it will pass current in one direction but not the other, and in the second state the direction of rectification is reversed. This oddity is explained by those who understand solid-state conduction as due in one case to conduction of electricity by a slight excess of free electrons, which conduct electricity in the same manner as free electrons in metals, and in the other case to conduction by the transfer of holes where electrons might be but are not because of a deficiency of supply.

On purely theoretical grounds, there was reason to believe that such a material might have its conductivity altered by subjecting it to an electric field. This theory suggested one way in which a solid-state amplifier might be made. An attempt was made to build such an amplifier, but since it did not work, an explanation was sought. Suspicion was directed at the extreme outer layer of the material, which is a region not so well understood as the interior. Various experiments were devised to modify surface effects. These included experiments to find the effect of light and also of contact with various metals and electrolytes, not just by cut-and-try but in an endeavor to analyze the surface state and to determine the conditions for transfer of electrons and holes along the surface and to the interior.

In the course of these systematic experiments, it was discovered that the resistance to the flow of electrons from a metallic point to a germanium crystal could be modified by applying voltage between the crystal and a drop of electrolyte placed on it close to the contact point. This result, together with other experiments, fitted into a theory consistent with the accepted theory of solid-state conduction by holes and electrons. The properties of an amplifier based on this control action were found to be limited by the characteristics of the electrolyte. Intelligent speculations and experiments were carried out to devise methods to avoid the use of the electrolyte. This led to the invention of the transistor, which operates on a different basic principle from any anticipated when the work was started.

By placing two points close together on a crystal of germanium, the surface of which had been carefully prepared, and by sending current through one of them in one direction, the resistance of the other is modified for current in the opposite direction. It is said by the theoreticians that the concentration of electrons in the region close to the first contact, both on the surface and in depth, is modified, and as a result the electrical characteristic of the nearby contact is modified. Thus the circuit through one point contact acts something like the grid-to-filament circuit of a vacuum tube, and that through the other, something like the filament-to-plate circuit—though this is not in fact a very sound analogy.

As I said earlier, the transistor is still in its infancy, and although several applications of it have been made in the laboratory and many possible uses have been demonstrated, it should not be expected to replace vacuum tubes generally. For many purposes it may be used as vacuum tubes are, but an even larger field of use may well be found where vacuum tubes cannot serve. The facts that no filament current and no warm-up time are required make it particularly attractive as a control device.

Out of the original transistor have already come a great variety of ideas for modifications and for applications. Meanwhile, the device is gradually being perfected into the rugged and reproducible unit that it must be for commercial use. In time, men, and money, this is, as usual, the big end of the job.

Progress in Industrial Research and Development

The three developments I have touched upon represent three of many ways of making progress in industrial research and development. I might have chosen any of numerous projects of comparable importance and found as many other patterns of action. There is no standard pattern, but there are some things in common for these three that apply to many others.

All of them are based on sound physical understanding and precise measurement. All represent pursuit of goals very difficult to achieve. None represents blind groping in the dark, yet none represents blind adherence to existing methods or designs. All were directed at securing the highest possible quality at the lowest possible cost, for that is our business; but all were directed also at improving our understanding of the things we work with, for that is our business too. All were the products of teamwork, drawing from the knowledge and skill of many workers of different talents. In each instance, mathematics, physics, chemistry, and engineering all played a prominent part. All drew from a broad background of scientific knowledge, and at the same time from an intimate acquaintance with communication technology and communication needs.

Important inventions were conceived by the workers on all three projects—but these inventions were not group products. They did not come automatically because an able group was put to work on a difficult problem. They arose just as inventions have always arisen, from the minds of imaginative men.

There was, in my opinion, just as much genius in these inventions as in inventions in the simpler areas of technology of earlier days. The technology of today is more complex, and deeper digging is required to unearth new ideas, but the ideas so unearthed still are a product of the mind. Inventions represent discernment of relationships that only become obvious after they are pointed out. They usually require overwhelming interest in and intense application to a specialized field.

The makers of these inventions to which I have referred worked in a favorable atmosphere for their inventive effort. They were exposed to new knowledge as it was unfolded by group attack on basic problems. They were provided with good tools of measurement. They were in a position to see practical needs. They had not only economic incentive, but also the satisfaction of contributing to advance toward an ideal.

It has been our experience that invention is not an automatic result of engaging in systematic research and development. This is indicated strikingly by the distribution of inventions among the individuals who participate. Actually, only about four per cent of them make half of all the inventions. It is easy to recognize the characteristics we have come to associate with inventiveness in those who are most prolific. Those who invent most are engineers or scientists who are not content to admit that anything is impossible. They delight in upsetting the pattern, and are more willing to try experiments that do not make sense in terms of accepted laws and traditions, but do make sense to their own intuition as to how things might work. They are usually idealists, yet they are practical, for they want to achieve useful results. They are apt to be sensitive. They are more interested in controlling the behavior of physical things than in managing other people. When an inventor becomes an executive, he usualy ceases to be an inventor.

The technical work of the modern industrial research laboratory is done by scientists and engineers ranging in character from the very methodical to the highly imaginative, and in occupation from the most fundamental research to detailed development for commercial manufacture and use. Some among these workers are outstanding inventors. With good surroundings and good tools, all are enabled to work effectively; with a sustained program of research, they have the benefit of accumulated knowledge special to the field in which they work; with well-defined objectives, they work effectively toward worthwhile ends; and with a common high ideal, they work together cheerfully with enthusiasm and zeal.

Concrete and Steel Structures of Various Forms and Sizes Are Springing Up on the Landscape to Speed Voices and Television Programs Across the Land

Radio Relay and Other Special Buildings

W. M. Marsters

RECENTLY an official of the Long Lines Department of the American Telephone and Telegraph Company was returning to New York by plane. As he approached the city, the young lady sitting in the adjoining seat, who had been looking out the window, said, "I wonder what that monument is down there."

The telephone man looked out and, recognizing the structure, said, "That, young lady, is a monument to telephone progress."

It was the Buckingham Mountain radio relay station, near the eastern border of Pennsylvania, and probably one of the best examples of the progress which has taken place in the years since Alexander Graham Bell spoke those famous words on his crude telephone in that Boston attic. And from where the young lady sat, looking down, the structure probably had the appearance of a monumental shaft rising from a cleared space on a wooded hilltop. If she could have seen it from the ground nearby, on the other hand, she might perhaps have noted its general resemblance to a tall lighthouse, which also transmits beams—but of light.

Most of the others of the total of 31 that have been erected on the New York–Chicago radio relay route, however, are truly monuments in their general design, and from high in the air might very well look like the famous Bok Tower in Florida—without the latter's decorative features. Unlike the Bok Tower, however, which was erected to please the esthetic sense and house the famous carillon, the radio relay buildings were erected for a strictly utilitarian purpose: to house the radio relay equipment and to place the antennas high enough in the air to do their job properly.

Radio relay is a term designating a microwave radio system designed to carry signals from one point to another point by relaying them at intermediate stations. The waves are projected in a straight line, like the beam from a searchlight (in fact, they are very much like light waves in many respects), and they do not follow the curvature of the earth like, say, broadcasting waves.

Incidentally, radio relay stations do not march overland in a straight line, but proceed slightly zig-zag fashion. This is to prevent possible interference if a transmitted wave should overshoot its intended mark, the adjacent station, and be received at an antenna farther along the route.

The radio waves are not seriously affected by haze, rain, or smoke: things which would prevent you and me from seeing between stations. There must, however, be an actual line-of-sight path between each two adjacent stations. So, to reach from one end of a radio circuit to the other, the originating station must see the first repeater (relay) point, that one must see the next one, and so on until the receiving terminal station is reached. In laying out a route, one of the clear-weather tests often made to see if there is an unobstructed view between two possible station sites is to flash a high-powered spotlight at one point and ascertain whether spotters at the second point can see the flashes.

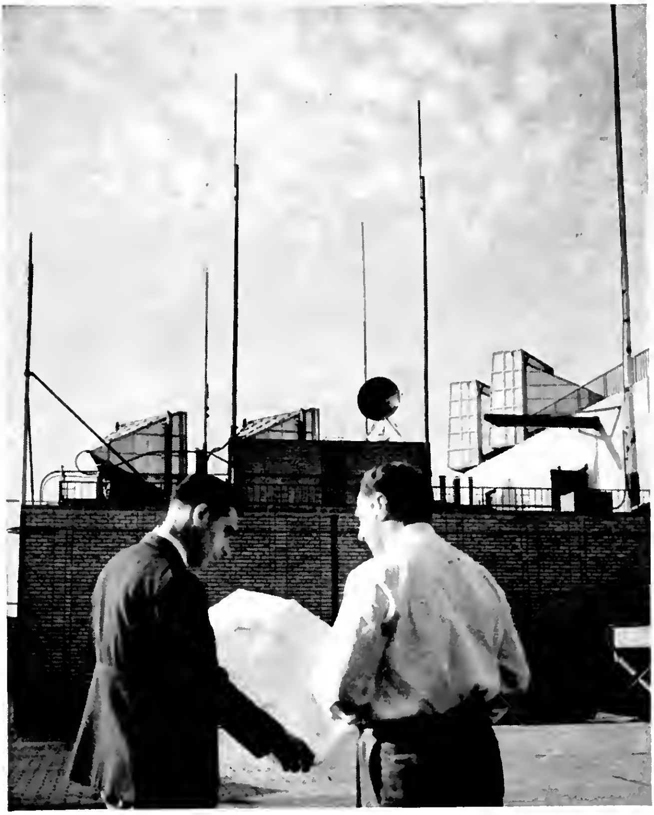
To get the waves started out in the proper direction, the antennas employed are of the directional type, each accurately pointed toward a similar receiving antenna located at the next station. These antennas must be mounted on structures of sufficient height so that intervening trees, hills, or other obstructions will not hinder the radio waves as they travel from station to station. The antenna-supporting structures must be rigid enough so that a high wind will not cause enough deflection in the direction the antennas are pointed to affect transmission.

Routes and Sites

SELECTION of location for radio relay stations presents problems fundamentally different from those for the location of structures required on open-wire or cable routes.

On these last, the all-important object is to construct the open-wire line or cable over the route which will be the best from the standpoint of ease and economy of construction and future maintenance, and of safety of the outside plant. Once the route has been selected with these considerations in mind, the buildings required along it must be located as required from a transmission standpoint, using the tolerances permitted in the spacing to keep the structures out of low spots where they might be flooded and as near roads as practical so that they will be accessible for maintenance. It may be said, indeed, that the location of buildings on open wire lines or cables depends almost entirely on the selection of the outside plant route. On radio relay systems, there is no physical plant along which buildings would be placed at some prescribed interval, so the method of determining where the intermediate relay points should be located is considerably different.

Let us consider what is involved in laying out a route between New York and Chicago by the way of Philadelphia, Pittsburgh, and Cleveland. That is just the general direction. There will, of course, be intermediate points—Harrisburg, Johnstown, and Akron, perhaps—which some day, if not now, will require connection with the relay system for telephone or television service. So the route selection must also take into consideration plans for getting into such cities either directly along its path or off the main route and reached by the use of side legs.



What happened to the roof of one telephone building when radio came along! On the top of the Long Lines headquarters building in New York are visible the New York–Boston and New York–Chicago radio relay antennas, antennas for mobile and other services, and—at upper right—a corner of the radio-relay equipment penthouse

This background sets up the general outline of the route. From here, the detailed job of actual lay-out starts. With a rough outline of the route, and general guides of procedure, what is the next step? Maps: the latest topographical if available; but, if these are not available, which is the case for some sections of the country, just maps—road maps, county maps, any maps which might give help. Topographical maps are of course the most useful, as they show not only roads and streams but also the height of the land—since, in general, it is desirable to get the stations as high up in the air as necessary to obtain clear paths over longer distances.

By the use of these maps, tentative routes are plotted on paper and field work is then undertaken. This consists of a complete coverage of the route, checking the heights of selected station sites and intermediate high points by instrument measurement and finding out such things as whether land is available, the amount of road construction required at the various tentative sites, the distance to power lines, and like matters. This requires a great amount of good old-fashioned work: traveling as far as one can by car and then climbing the hills by shanks mare over roads or trails if they exist—but get up there anyway!

One of the seven hilltop radio relay stations along the route between New York and Boston. This location is Jackie Jones Mountain, near Haverstraw, N. Y.

usually obtain an option on the properties first so that transmission measurements may be made. To make these measurements, light-weight sectional towers are erected at two adjacent stations, radio waves of the frequencies to be used are transmitted from one station to the other with the antennas located at different heights on the towers, and readings are made of the received currents. From these readings it can be determined whether the transmission path is satisfactory and also the height of the structures which are required. When all these factors prove to be satisfactory, the land is purchased and the building man is ready to go to work.

—so that the entire route has been looked over and checked and the best station sites have been noted. The work then returns to the office and detailed route maps of the different possibilities are prepared for study from transmission, cost, and other standpoints. As a result of these studies, the route is selected. There then remain the details of obtaining the properties for the stations and making final transmission tests to insure that the paths between sites will be satisfactory.

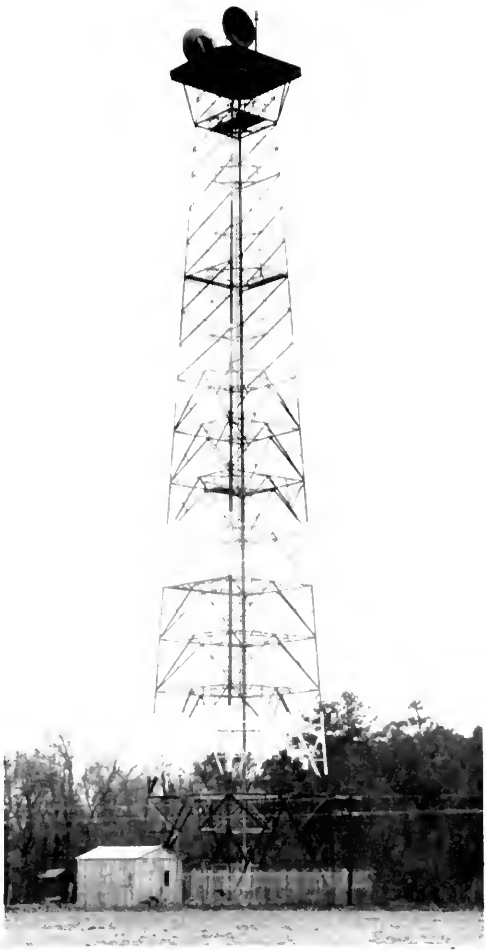
The job of obtaining the sites is turned over to the legal people, who

Designing New Structures

Radio relay is a comparatively recent development in long distance telephone and television transmission. Research, tests, and actual experience have modified some of the original ideas about how it should operate, and those changes have been reflected in the building designs.

The first of the long-haul radio relay systems to be placed in service was the New York–Boston system, which uses equipment of an experimental type. This route starts from the top of the Long Lines headquarters building at 32 Avenue of the Americas, in New York, some 450 feet above sea level. There it jumps to Jackie Jones Mountain, on the edge of Palisades Interstate Park in back of West Haverstraw, N. Y., then to Birch Hill to the north of Brewster, N. Y., and on to five other stations. The last stop is the roof of the New England Telephone and Telegraph Company's Bowdoin Square building, 220 feet above sea level, in Boston. Being located in hilly country, with clear paths between stations, the buildings required for this system did not have to be of any great height—the highest only 52 feet above ground. A review of the equipment to be used indicated that it could be placed in a two-story building about 24 feet square. The design settled on was such a building, having four corner columns and one center column of reinforced concrete, with walls of concrete blocks. The columns were extended above the roof to the height required and a platform was constructed there for the antennas.

The next group of buildings to come under consideration were those for the New York–Philadelphia (Wyndmoor) section of the New York–Chicago route, and for the Chicago–Milwaukee route. It was known that at many locations substantially taller structures than the New York–Boston system would be needed. The engineers thereupon cast about to see if there was any type of commercial structure which might be adapted to the need. Their eyes fell on a tall reinforced-concrete chimney,



A 200-foot steel structure, with the equipment building at its base, near Newtown, Va., is a unit of the Richmond-Norfolk branch radio relay route

and that is what they used at the start: a tall, tapering chimney with five interior floors for equipment, topped off with two antenna platforms.

The use of the chimney structure had its merits at the time, as it involved only small design changes to make it adaptable for radio relay use, and contractors had on hand the necessary erection forms. It did, however, have the objection that goes along with fitting square pegs in round holes: that is, the equipment to be used was designed for straight lines of bays and it was difficult to obtain good floor layouts without wasting space.

When it became evident that radio relay was to become one of the major systems for furnishing long distance facilities, a firm of consulting engineers was engaged to make studies, in coöperation with our own engineers, and to design a type of structure best suited for the job. Many and interesting were the conferences which took place before a design was accepted, since there were advocates of round, square, concrete and steel structures, and combinations of them.

The final decision was the square structure which by now may be familiar through reproduction in both telephone and general periodicals. It combined two requirements: it could not only provide the necessary elevation, to get the antenna horns up to required heights, in increments of about 15 feet, but also it had room within the structure for the equipment. The latter ability was considered essential, as tests had indicated serious transmission impairment under certain conditions if the waveguides (the hollow metal tubes used in place of wires to connect the radio equipment to the antennas) were too long. If the equipment was located on floors placed as desired inside the building, the length of these waveguides could be controlled. The structures, being of reinforced concrete, were extremely stable.

A total of 49 of these structures, of varying height, was erected in 1949 and early 1950, stretching from Philadelphia to Des Moines by the way of Pittsburgh, Cleveland, and Chicago; from Cincinnati to Columbus; from Albany to Syracuse; and from Buffalo to Rochester. This was really a prodigious job.

Some of the buildings were erected by the fixed form method of construction, whereby a form for a certain part of the height—one floor, in this instance—is put in place, the concrete is poured, and time is allowed for it to harden, after which the form is raised for the next higher section, concrete is poured, and so it goes until the top is reached.

The rest of the buildings were erected by the continuous pouring or slip-form method—something like raising oneself by his own boot straps. In this technique, concrete is poured into a form which is raised by jacks, about seven inches an hour in the case of radio relay buildings. Once the job of pouring the concrete is started, it is carried on continuously, day and night, rain or shine, until it is completed. This means that the outside walls of the highest concrete structure built in 1949 were completely poured in two weeks. This does not finish the job, of course, as floors and antenna decks must be poured, stairways erected, and electric wiring installed; but the over-all job really is fast. Most of these buildings were erected in the rural sections of the country, and it did not take long for the word to get around that something interesting was going on. Week-ends, especially, the sites were the mecca of all the surrounding countryside. Whole families would show up and spend hours watching the work. In the cities they would be called sidewalk superintendents, while out there they were obviously field engineers.

Skeletal steel structures carefully designed to provide the desired rigidity, have been erected for some of the branch route radio relay systems. Some have an equipment room at the top, with a power building near the base, and others have only the antennas mounted at the top, with both equipment and power located in a building at the base. In other cases, where a hurry-up job for a short time has been involved, telephone poles have been used for the antennae supports and construction shanties for the equipment.

For the new radio relay structures required in the latter part of 1950, it is planned to make more use of open steel structures, with the radio and power equipment usually located in a building on the ground. In some cases, however, the radio equipment will be in a room located part way up, with the power equipment on the ground. This change, which studies indicate will save money in building construction, has been found practicable as the result of experience over the past year. Designs have been worked out to obtain structures for general use for heights up to 250 feet in increments of 12½ feet. A design has also been completed for a steel tower more than 400 feet tall which will be erected adjacent to the telephone building in Des Moines, Iowa. In this case, the equipment will be located in a penthouse on the roof of the telephone building.

Locations for buildings for wire communication systems are generally independent of terrain, and definite rules have been made and are followed for the spacing between stations. This is not so for radio relay systems: with them, it is a case of setting them up about as far apart as possible—taking into account both technical considerations and the country along the route. For flat country, assuming the use of struc-

The antennas visible near the top of the the left face of the tower of this commercial building in Columbus, O., are 450 feet above the street—much higher than the elevation offered by the roof of the local telephone building tures about 200 feet high, the spacing might be only 20 miles between stations. If two high mountains could be found on which stations could be placed, with a broad, flat valley between, much wider spacing might be employed. Then again, a very short spacing might be required, perhaps not more than 10 miles, which could be the case when getting into a city over chimneys, and buildings, even though structures as high as practicable were used on the terminal building and at the adjacent station. On the New York–Chicago route, the shortest spacing is 13.1 miles, the longest 38.6 miles, and the average is 24.6 miles.

This radio relay development is changing the appearance of the roofs of the telephone buildings in a number of cities. At one time a roof was just a roof—but not so now if radio relay comes its way. If it is tall enough for the antennas, fine!; they will be mounted on an ordinary platform of sufficient height to clear any roof obstructions. If not, up goes a supporting structure for the antennas, the tallest to date being one 110 feet above the roof. If there is no space on the upper floors for the equipment, a pent-house is built for it on the roof, as has been required in a number of places.

Before construction of radio relay structures is started, certain government regulations must be met. There are rules as to how high a structure may be, in relation to its distance from an airplane landing field or if it is in a flight zone. Also there are rules for installing obstruction lighting under certain conditions and for stripe painting of steel open structures. It is a pleasure to note that the coöperation of and the assistance received from the government representatives in these matters has been of great assistance in expediting the work.

Special Buildings for Long Distance

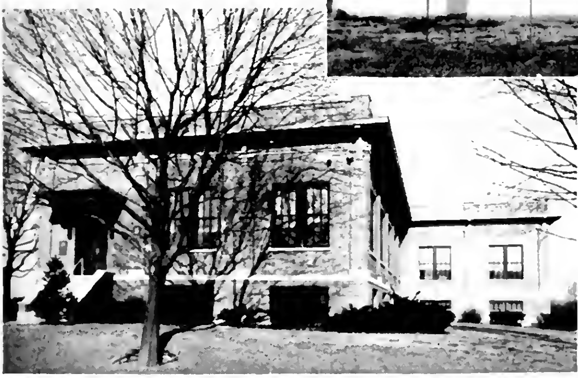
The erection of buildings for use exclusively for long distance telephone service is, of course, nothing new in itself. Only the designs, based on the requirements, are new as different types of communication systems are developed.

In the very early days of long distance telephony, test stations were located at different points along the open-wire routes. In a number of cases these were the residences of the section linemen, and the testboard, usually operated by the lineman's wife during the day, was in one of the rooms. Then there were the "Rx" offices, on the outskirts of large cities, where "through" switches were made to avoid the transmission loss through the cables into the toll office in the city. Practically every large city had an "Rx" office in its day; but most of them have long since been given up, since the transmission loss of the toll entrance cables is no longer a matter of moment.

Shortly after the development of the vacuum-tube telephone repeater came the development and rapid expansion of the use of small-gauge wires in cable for long distance transmission. This caused a boom in the building program for the next few years, as stations to house the telephone repeaters required much closer spacings than had been required on the open-wire lines.

Left: In harmony with its residential location, this building serves nevertheless as a voice-frequency repeater and coaxial main station

Right: This typical ranch house in Abilene, Tex., is actually a coaxial main station



Left: The front section of this structure, built in 1917 in Princeton, N. J., was the first building erected primarily for telephone repeaters on 19-gauge toll cable. It now houses voice, K, and coaxial repeaters, and last year was cited by the Garden Club of the State for contributing to the beautification of New Jersey's highways

In the latter part of the '30s, the broad-band carrier systems, known as the Type K system for cable and the Type J system for open wire, were made available. Again the building engineer went busily to work, as the building requirements for these systems were different from anything previously required. The equipment was designed for automatic operation, with attendance required only in case of trouble or for periodic testing and adjustment. Buildings with standardized floor plans to insure economies in engineering and equipment installation were designed. These were fire resistant and included arrangements for temperature control, protection against marauders, and burglar and other alarms. In the next few years some 500 of these buildings were erected, in about every conceivable location from cities to back roads and from vineyards to deserts.

The development of the coaxial cable, on which the Type L broadband carrier system operates, brought in its train another job for the building engineer. This was the design of a small intermediate repeater station in which there would be very little temperature variation over a 24-hour period. With the large variations of outside temperature which may occur between the hottest part of the day and the coolest part of the night, maintaining a small temperature range within the structure presented quite a problem, especially as no power would be available to accomplish it by artificial means.

The answer was obtained by "mass construction," using 16-inch concrete block walls, a concrete floor and ceiling, and placing 10 inches of insulation over the ceiling. Before the heat of the sun has had time to penetrate the walls to raise the temperature inside, night cools off the walls, and then the cycle starts all over again. Close to a thousand of these buildings, most of which are about 7 by 10 feet in inside dimensions, are now in operation.

In general, structures for intermediate repeaters for all types of such systems are located in suburban areas, and this has been taken into consideration in designing the buildings and grounds. Where appropriate because of the surroundings, especially in residential areas, the buildings have been designed and the grounds landscaped in keeping with the neighborhood. Proper maintenance of buildings and grounds is the pride of the station personnel. Interestingly enough, the Princeton, N. J., repeater station, which is the oldest of the voice cable repeater stations, was one of 60 commercial and industrial establishments to receive from the Garden Club of that state a 1949 citation for civic achievement for contributing to the beautification of New Jersey's highways.

As compared to the building requirements for intermediate stations, those for the terminals of new types of systems have changed very little over a long period of years. A building that was constructed years ago for, say, manual switchboard equipment would have the proper floor strength and ceiling heights for the newer types of dialing equipment, either local or toll, or could be used for the newer types of long distance telephone systems. The New York No. 4 Toll Switching System, for instance, our largest toll dialing center, and placed in operation in the latter part of 1948, is located on floors which were erected about 1917 for future manual toll switchboard use.

From a long distance communication standpoint, the development of the voice frequency cable, broad band carrier, and coaxial cable facilities have improved the quality of the service while reducing the cost to the public over the years. The development of radio relay has presented for certain situations another communications tool; and while experience with it so far is limited, its expectations are high in the minds of those who are working with it. Future developments, whether they be complete new systems, or changes in radio relay or other of the present systems, will no doubt pose many problems of building design and construction. But there seems to be reason, based on past accomplishments, to believe that the building engineer will do his part to produce something better and at the lowest cost which comports with efficient operation.

A Fourth of All Calls, Including More Than Half of the Toll Calls, Begin or End at Switchboards the Telephone Companies Do Not Operate

The PBX Side of Telephone Service

Lewis M. Fuehrer and Glen Whiteman

THE PRIVATE BRANCH EXCHANGES * which are served by the Bell System far exceed in number all the local and toll central offices which serve them.

About 175,000 women are employed to operate these 140,000 private branch exchanges: employed not by the telephone companies but by the customers on whose premises the equipment is installed.

About one fourth of all the telephone calls handled by the Bell System begin or end at private branch exchanges, and more than half of all the toll calls go through these switchboards. And there are, of course, innumerable "internal" calls which go through only the one switchboard.

These calls are a substantial part of Bell System business, obviously; but, as is equally obvious, the operation of the switchboards where they originate or terminate is out of the System's hands. The System can be only indirectly responsible for the quality of that much of the service.

Yet, to the public in general, the Bell System *is* responsible for the quality of all telephone service and not just part of it. The System just cannot avoid it.

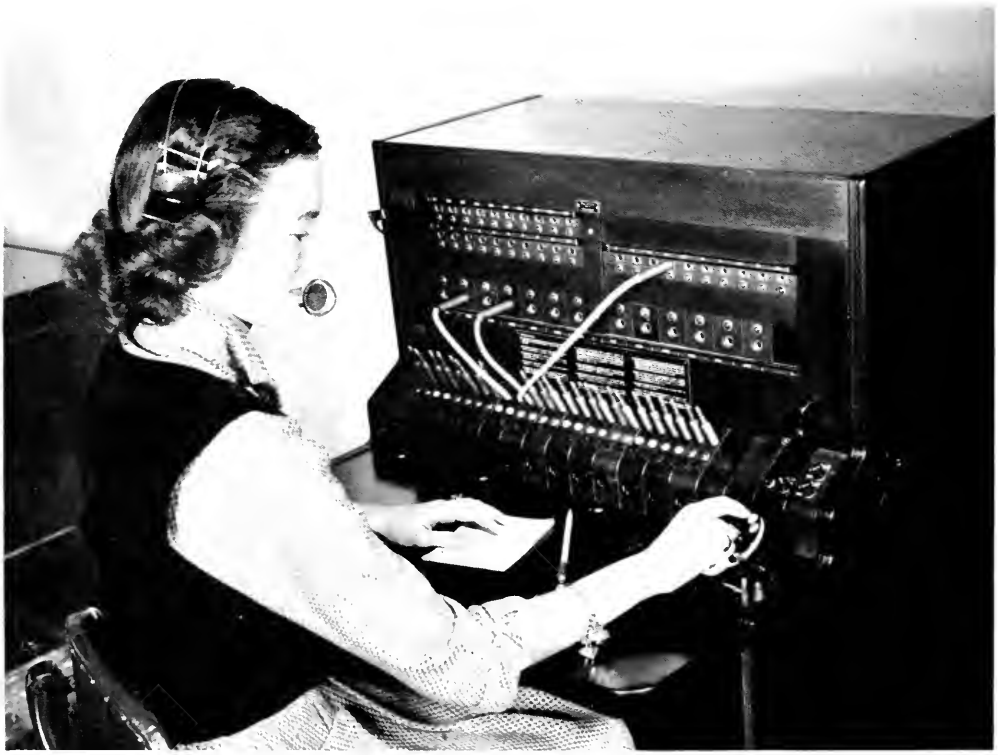
What the System is doing to help keep up to Bell standards that share of its business which it serves but does not control is the subject of this discussion.

* A private branch exchange, commonly abbreviated to PBX, is basically a switchboard installed by the telephone company on a customer's premises to provide interconnection among his several telephones and also between those telephones and most of the telephones in the world via the telephone company central office which serves him.

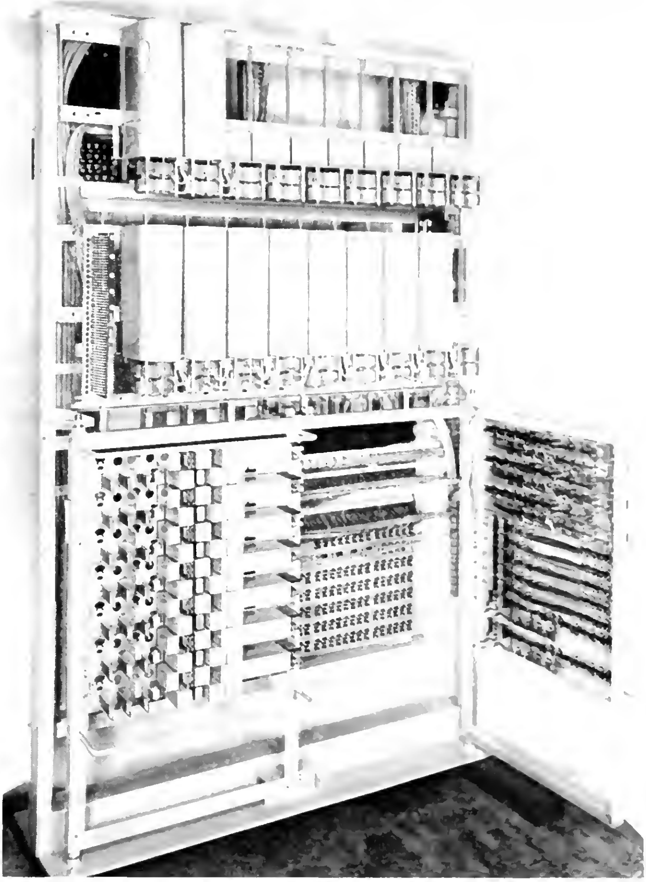
Equipment and Attendants

By 1879—the year after the first commercial telephone exchange in the world was established—the first PBX was placed in service. Soon the value of this kind of equipment for providing a fast intercommunicating service for the telephones within an organization was recognized, and the demand for it increased. Through more than 70 years, customers' service requirements have grown more complex, and the design of PBX switchboards has paralleled the development of new types of central-office switchboards with improved operating features. Today, Bell System companies offer their customers, for use on their own premises, various standardized types of cord, cordless, and dial switchboards; miscellaneous facilities, such as conference equipment, code calling equipment, and tie trunks; and equipment, such as order turrets, to meet special requirements.

PBX switchboards need attendants, and telephone companies very quickly found themselves not only furnishing the equipment but helping customers to find attendants—and then training them in its operation. That process still continues. So does the tradition of courteous service which it inculcates. As long ago as 1904, Bulletin No. 11 of the Amer-



A "streamlined" private branch exchange switchboard recently placed in service. The arrangement of cords and keys is more convenient for the attendant, and there is more working space on the shelf in front of her, than in earlier models ican Telephone and Telegraph Company, "Private Branch Exchange Operating Methods," declared: "In central office operating methods, it is the first requisite in an operating force that the operators be trained to uniform and courteous methods in dealing with the public. This requisite applies with equal force to the operators at a private branch exchange. The requirement that private branch exchange operators shall exercise courtesy in the performance of their duties applies not only to their dealings with their immediate employers, but also to their dealings with the outside public, and with operators at the central offices and at other private branch exchanges. A business house can no more afford to have discourteous operators than it can afford to have discourteous clerks to receive customers."



An "inside" view of recently developed switching equipment for a dial system serving 80 extension telephones

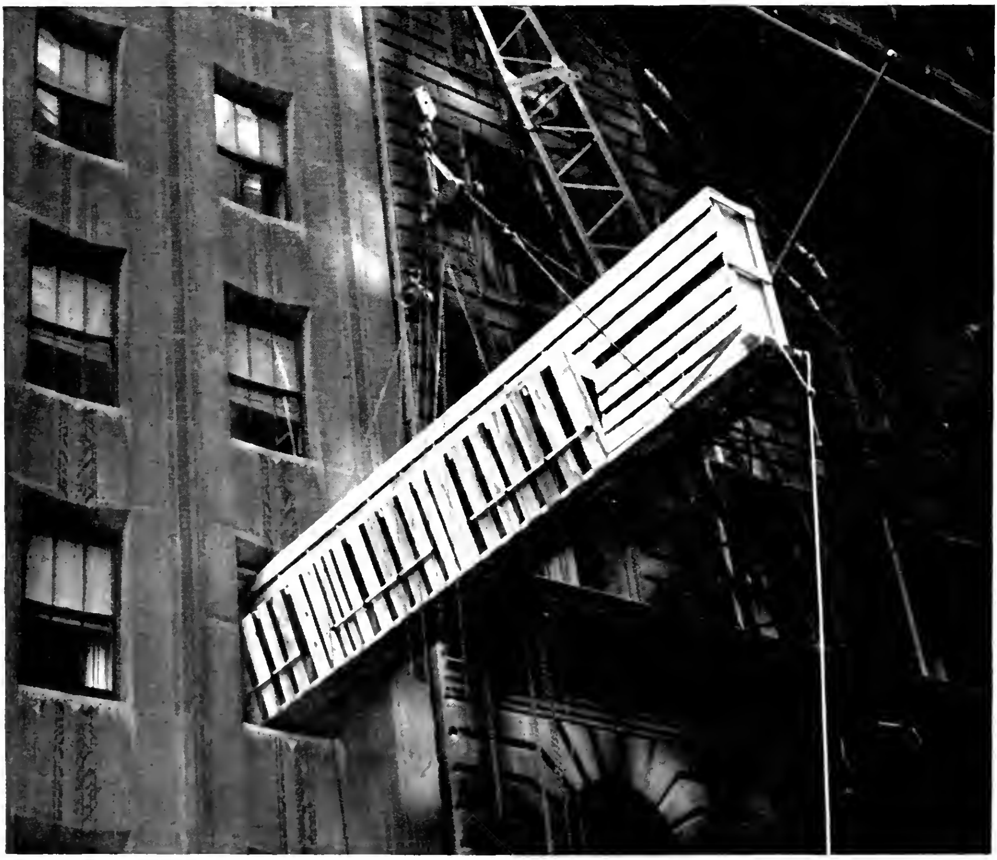
Not only are PBX attendants courteous in the performance of their duties, but they are actuated by the same "spirit of service" as are their sisters at the central-office switchboards, and many have had opportunity to manifest their loyalty and resourcefulness. Private branch exchange attendants do not come within the scope of the Bell System's Vail Medal awards, yet seven medals have been especially voted to PBX attendants for noteworthy acts of public service. Of this number, three were posthumous awards to women who gave their lives that others might live.

Elements Affecting Service

Many private branch exchange installations are tailor-made to meet the individual service requirements of a particular customer. Yet, in the design of each system, many factors other than the customer's individual service requirements must be taken into consideration.

Every installation is an integral part of the nationwide telephone network, and all the various circuit components are properly designed to be linked with local central office circuits, toll circuits, and circuits to other private branch exchanges in the Bell System. Each board must be properly engineered, installed, administered, and maintained, and uniform operating practices must be prepared, in order to insure efficient and economical operation and to avoid service faults on calls to or from other customers.

The grade of service on every incoming call is affected by the design of equipment and by the service rendered by the attendant in handling the call. When Mrs. Smith, in San Francisco, calls Mr. Smith at his hotel in New York, it is not just by accident that the connection is established even though Mr. Smith is not in his room. Special operating practices for such conditions have been introduced at most hotels; and in this case the private branch exchange attendant,



This 26-foot private branch exchange switchboard, weighing 8250 pounds, is being maneuvered entire through the window of a large bank

Here is the same 8-position switchboard—shown opposite—in service

upon being told by Mr. Smith that he will be available in the dining room, places a distinctive signal plug in all appearances of his line at the switchboard, indicating where he may be reached and permitting Mrs. Smith's call to be completed promptly.

New types of equipment are constantly being designed, to keep pace with the development and growth of communication requirements and to meet the different service needs of many customers.

A new console type of manual switchboard is now being provided for small installations of one or two positions. Streamlined in appearance and equipped with removable outer casings which may be finished in different colors to harmonize with the interior of the customer's office, it embodies many new operating, equipment, and maintenance features. These include additional bulletin and writing space, improved ringing and talking keys, and automatic grouping of positions for light-hour operation. There are also self-contained cord and trunk units which may easily be added to, removed, or relocated, thus making possible a close adjustment of the equipment to the "load requirements"—number and kinds of calls—without interference to the service.

Two new PBX switchboards have

This "still" is from "The Invisible Receptionist," a motion picture about the work of PBX attendants which was made particularly for showing at group meetings and other suitable occasions

been made available for use at large manual and dial installations. One embodies special operating and service features such as automatically started machine ringing on calls to telephones it serves directly; "audible flashing recall," whereby a single movement of the switch hook to recall the attendant causes the supervisory lamp to flash intermittently and an audible signal to sound until the attendant answers or the caller hangs up; and idle trunk indicating. The other is designed for use at installations where the customer does not require all these features. However, it is arranged for idle trunk indicating, and has an optional arrangement for audible flashing recall.

One package-type dial private branch exchange is new to the service. It is designed to facilitate the engineering and installation of small dial systems and to assist the Associated Companies and the Western Electric Company in providing dial equipment for them. One important feature is that incoming tie trunks from an associated private branch exchange are so arranged that the calling PBX telephone may dial the called telephone without the assistance of an attendant at either location. Another feature provides switches arranged to hunt over a group of lines which serve employees doing the same type of work in order to permit connection to the next idle line in the group when the line that has been dialed is busy.

The availability of the various sizes and types of systems does not in itself mean that for a given number of telephones a particular type of switchboard is required. Requirements vary considerably, and in some cases the operating characteristics of concerns having the same number of telephones differ so widely that it is necessary to provide twice the amount of switching equipment for one as for the other. A hotel with 3,000 telephones, most of which are in the guest rooms, may require a 20-position manual switchboard, for instance, while an industrial concern with 3,000 telephones may require a 40-position manual switchboard to give the same grade of service. This difference is due primarily to the large number of intercommunicating calls in the large industrial concern and the relatively small number of alls between guest rooms in the iotel.

ɪɴᴄᴇ each installation is engineered o meet the individual service requirenents of the particular customer, tudies must be made of the numerous onditions which affect these requirenents before the equipment can be nstalled. Calling rates, holding imes, distribution of intercommuniating, outgoing, incoming, and the 'arious types of tie trunk traffic all iave direct bearing on the type, juantity, and arrangement of equipnent to be provided. The number of switchboard positions is deternined by the amount of time it takes he attendants to handle the traffic which in turn is determined by the number and classes of calls to be handled. It may take twice as long to handle certain outgoing central office calls as it does to handle internal calls completed direct to the station multiple, and still longer to handle certain classes of toll calls.

In most cases, the studies embrace a consideration of both manual and dial private branch exchanges, so that the customer may have the benefit of expert guidance and experience in the selection of equipment which is best suited to meet his service requirement. Floor plan layout, lighting, ventilation, operating room appearance—in fact, most of the factors involved in engineering a new

This group of private switchboard attendants is meeting with telephone company Service Advisers to discuss service matters of mutual interest central office—are taken into consideration.

Many customers have separate private branch exchanges in two or more locations which are interconnected by means of tie trunks between them. The advantage of direct connection between distant points of an organization was realized early in the telephone industry. When the Brooklyn Bridge was being built, the following item appeared in one of the local newspapers: "A Bell telephone has been put in operation between the office of J. Lloyd Haigh, of 81 John Street, and his steelworks in South Brooklyn where the wire for the great cables is being made. The wire passes through Buttermilk Channel and across the East River and is about five miles long. Conversation is carried on with ease . . ."

Today, one of the largest steel companies, with numerous private branch exchanges in 29 different cities in 10 states, is provided with hundreds of miles of Bell telephone facilities, not only for interconnecting the private branch exchanges within each city but also for connecting together those in key cities in different states and different Associated Companies.

Another example of large size and elaborate engineering of PBX facilities is found in the interdepartmental dial switching system which serves

These PBX attendants (left), visiting a telephone company central office, discuss service matters with the chief operator

' "social hour" concludes a visit of PBX attendants to the telephone company, and conduces to pleasant acquaintanceship among women with a common interest

'arious Government agencies in Vashington. It includes more than ;000 switches and 2900 tie trunks .nd interconnects more than a hunlred separate private branch exhanges. This installation handles 'rom 115,000 to 120,000 calls in the ourse of an average business day—ınd that is more calls than are ıandled in that period in some fairized cities.

Toward Good PBX Service

THE PBX SWITCHBOARD has been called the nerve center of the modern business organization. In many organizations, practically all of its telephone communications involve private branch exchange facilities; and from the standpoint of the customer, the installation of the proper type and quantity of equipment is just the beginning. One of his most important problems is the hiring and training of regular and relief attendants for handling the calls that pass through the switchboard. Bulletin No. 11, already mentioned, also suggested that the telephone companies employ experienced supervisors to visit regularly the private branch exchange switchboards and give the attendants such assistance as they may require. Today there are nearly 800 Traffic Department employees assigned to visiting, training, instructional observing, and placement work. During the past year, more than 320,000 visits were made by PBX Service Advisers, as they are now called; and on about half these visits, executives of the customer organization as well as PBX attendants were interviewed.

There is, of course, close coördination among the several departments of the telephone companies in carrying on the various phases of the PBX job, and to the interviews of the Traffic Department's Service Advisers can be added an equally large number of interviews which the Commercial Department's sales and servicing specialists hold with the PBX customers themselves.

In the larger cities, Bell telephone companies maintain training departments where instruction in PBX operating is given to new attendants. These are preferably people already employed by the customer, for such people are already familiar with the establishment and find less difficulty in completing calls to individuals and departments. In the smaller cities, the training is usually done by the Service Adviser at the switchboards that the attendants will operate. About 35,000 attendants were trained last year.

This work with the attendants is effectively supplemented by a program of Commercial's servicing forces to promote good telephone usage and habits among PBX telephone users.

Attendants call on their Service Advisers for assistance in perfecting their operating technique and in meeting the many different problems encountered in giving a personalized service at their switchboards. Their work is in many ways more complex than that of the central office operator, for they are often required to give many services of a somewhat secretarial nature.

Each problem is individual in itself. For example, an extension user may request the attendant to place all toll calls for him, and hang up after giving his order. Of course, this practice is a carry-over from earlier days when a recording operator in the toll office took the details of the call and advised the calling party that he would be called back when the connection was ready. With today's toll service, and particularly with operator toll dialing, the extension user who remains on the line will be talking to the called party in a minute or less on most calls.

One condition which Service Advisers not infrequently encounter at small PBX switchboards is the assignment to the attendant of other duties which inevitably interfere with her primary responsibility of handling telephone calls. An incoming call left unanswered while the attendant is busy at the files or—believe it or not!—delivering the mail, may of course mean a disgruntled buyer who takes his order elsewhere.

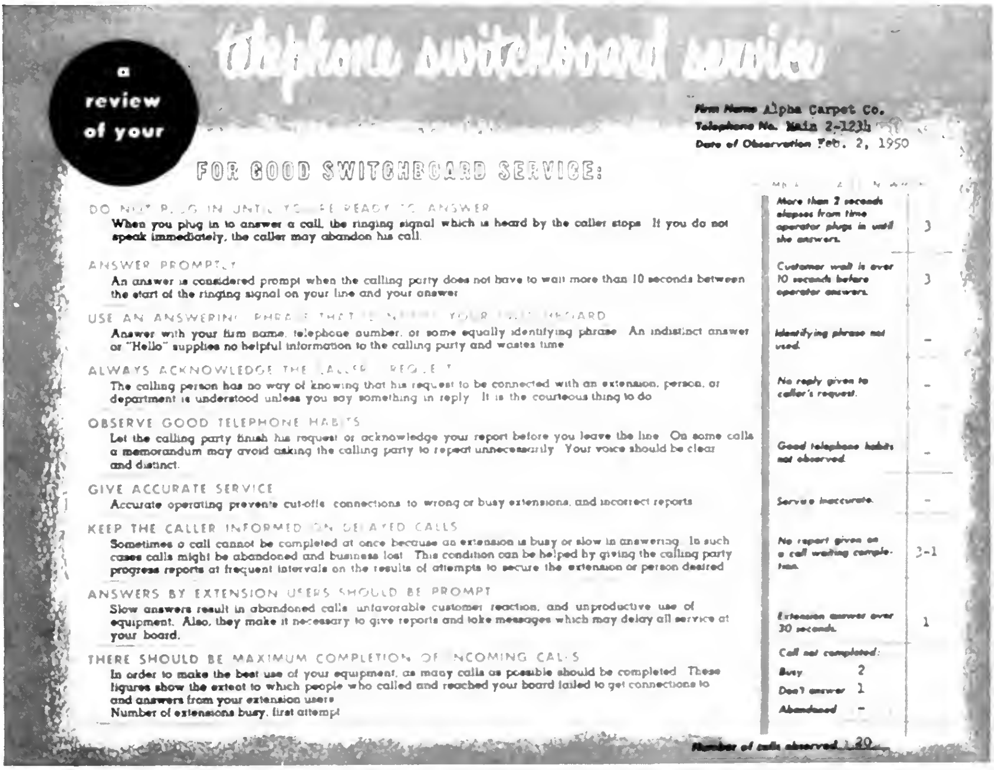
Some establishments require rather elaborate records of calls, in order to bill them to departments or individual extension users.

Many demands are made upon the attendants by their extension users in the way of following up calls where the called party is out or where the call is intercepted by a secretary who waits to put her supervisor on the line until she learns who is calling and what about.

The attendants at many switchboards also handle numerous calls from outside parties regarding information of a general nature. This is particularly true at switchboards which serve governmental agencies and those which serve newspapers and public utilities. Some newspapers maintain special information departments to which questions are referred.

The Service Adviser from the telephone company is often able to assist a PBX attendant in other than technical operating matters. She can, for example, bring to the attention of an executive of the customer's organization, either directly or through the Commercial servicing representative, certain problems which lower the quality of telephone service and which the attendant alone is unable to correct. Such things as slow answers by extension users, and extensions which are in use an inordinate percentage of the time, are beyond an attendant's control, but can often be corrected without difficulty when their adverse effect upon his service is pointed out to the customer. The customer—often as represented by some official or executive of the firm—is usually not only cooperative, but grateful to the Service Adviser or other representative of the telephone company for the interest shown in improving his service.

An occasional additional duty of the Service Adviser is to supervise the collection of traffic data which summarize the extent to which PBX equipment is being used. Various types of calls, and conditions which affect operating work time and circuit



a review of your telephone switchboard service

Firm Name Alpha Carpet Co.
Telephone No. Main 2-1234
Date of Observation Feb. 2, 1950

FOR GOOD SWITCHBOARD SERVICE:

DO NOT PLUG IN UNTIL YOU'RE READY TO ANSWER
When you plug in to answer a call, the ringing signal which is heard by the caller stops. If you do not speak immediately, the caller may abandon his call.

ANSWER PROMPTLY
An answer is considered prompt when the calling party does not have to wait more than 10 seconds between the start of the ringing signal on your line and your answer.

USE AN ANSWERING PHRASE THAT IDENTIFIES YOUR SWITCHBOARD
Answer with your firm name, telephone number, or some equally identifying phrase. An indistinct answer or "Hello" supplies no helpful information to the calling party and wastes time.

ALWAYS ACKNOWLEDGE THE CALLER'S REQUEST
The calling person has no way of knowing that his request to be connected with an extension, person, or department is understood unless you say something in reply. It is the courteous thing to do.

OBSERVE GOOD TELEPHONE HABITS
Let the calling party finish his request or acknowledge your report before you leave the line. On some calls a memorandum may avoid asking the calling party to repeat unnecessarily. Your voice should be clear and distinct.

GIVE ACCURATE SERVICE
Accurate operating prevents cut-offs, connections to wrong or busy extensions, and incorrect reports.

KEEP THE CALLER INFORMED ON DELAYED CALLS
Sometimes a call cannot be completed at once because an extension is busy or slow in answering. In such cases calls might be abandoned and business lost. This condition can be helped by giving the calling party progress reports at frequent intervals on the results of attempts to secure the extension or person desired.

ANSWERS BY EXTENSION USERS SHOULD BE PROMPT
Slow answers result in abandoned calls, unfavorable customer reaction, and unproductive use of equipment. Also, they make it necessary to give reports and take messages which may delay all service at your board.

THERE SHOULD BE MAXIMUM COMPLETION OF INCOMING CALLS
In order to make the best use of your equipment, as many calls as possible should be completed. These figures show the extent to which people who called and reached your board failed to get connections to and answers from your extension users.
Number of extensions busy, first attempt

More than 2 seconds elapses from time operator plugs in until she answers.	3
Customer wait is over 10 seconds before operator answers.	3
Identifying phrase not used.	-
No reply given to caller's request.	-
Good telephone habits not observed.	-
Service inaccurate.	-
No report given on a call waiting completion.	3-1
Extension answer over 30 seconds.	1
Call not completed: Busy	2
Don't answer	1
Abandoned	-

Number of calls observed 120

Analyses of customer PBX service are made at their request, and are summarized in such fashion for the guidance of attendants and Service Advisers

PBX practices, service notes, personnel publications, and reminder cards are among the items distributed to attendants to help them to give good service holding time, are encountered at PBX switchboards, and accurate information is important to the telephone company engineer in planning facilities for growth or for the installation of some new type of equipment.

Invited Guests of the Telephone Company

PBX ASSISTANCE is a two-way street: the telephone companies' Service Advisers visit the PBX attendants at their switchboards, and the attendants likewise visit the telephone companies. Meetings of attendants on telephone company premises are a regular part of company PBX programs.

Typically, a group of attendants is welcomed by a Traffic Department representative who is concerned with their work, and a general discussion of problems of common interest is held under company leadership. A conducted visit may be made to local or toll switchboards or other equipment. Perhaps a Bell System motion picture—"The Invisible Receptionist," for instance—is shown. There is likely to be a social hour after the business in hand is completed, and probably some simple refreshments.

By the time the guests are ready to leave, they have accomplished several things. Those who had problems in connection with their jobs may have received the solution—or at any rate have heard some helpful discussion and perhaps sound advice. They have formed pleasant contacts with fellow workers in the same field of endeavor. They may have met some of the telephone company operators who handle the calls they originated at their PBX switchboards, and established an *esprit de corps* with them. They take away with them, it seems likely, a "lift" from the realization that they play an essential part, with the Bell System, in helping to provide a nation-wide service of the first importance.

That this isn't phantasy—or wishful thinking—is attested by the numbers present at such meetings. Of the attendants invited to an evening meeting, on their own time, 75 percent are likely to show up—and some of the rest will ask to be included another time. To such meetings held during business hours, customers are likely to arrange to send their PBX attendants with their blessing.

THE TELEPHONE COMPANIES of the Bell System supply PBX switchboards and equipment to their customers at tariff rates. They could let it go at that. Instead, they go to great pains to see that those customers enjoy good service.

Helping customers to find attendants, and then training them, assisting them to solve their service problems, stimulating their sense of accomplishment—all this is an extensive and important activity for which no charge is made. But it keeps the service standards high throughout this country and assures that these customers get the utmost in effectiveness from their equipment.

The Educational Objective of the Telezonia "Package"

Arthur C. Stenius

Dr. Stenius is Professor of Education and Director of the Audio-Visual Materials Consultation Bureau of Wayne University, Detroit, and served as consultant to the A. T. & T. Co. during the research, production, and classroom testing of the "package" comprising the Telezonia project. EDITOR.

CHILDREN learn more when such instructional materials as films are used in the classroom. This fact is no longer news. The lack of suitable materials, however, still forces many teachers to fall back on less effective methods and sources of instruction.

The importance of the telephone in the life of a youngster has been realized for many years. But up to now, the individual teacher had to develop her own material for teaching the "how" of getting children to understand the importance of good telephone habits and gain skill in them.

This is why the motion picture and supplementary teaching aids recently developed by the Bell System are so significant. Whether a teacher wants to motivate pupils in the study of telephone usage, to impart information, or to develop skills, suitable materials are now available for her use.

Moreover, classroom try-outs of these materials have assured us in the teaching field of their effectiveness as instructional devices. Their value is the result of the careful testing that was done at each stage of their development—from the decision to produce a motion picture through to the classroom activities suggested in the material itself.

The entire package has been planned for classroom use. What would serve teachers best has at all times been the controlling factor. The results of this policy are evident in the materials. They will serve well the teachers of the nation. For no longer will teachers be handicapped in instructing in the use of the telephone by lack of effective materials. We as educators hope that the way the Bell System has gone about producing these instructional aids may be of use to other institutions anxious to help the schools in preparing youngsters for living in our modern, complex world.

A "Package" of Materials for Instructing Grade-School Children in Good Telephone Usage Has Been Prepared Under Professional Guidance to Meet Classroom Needs

Adventure in Telezonia

LeRoy A. Born

TELEZONIA? What is that—and where?

It is a new and fanciful land, inhabited by gnomes, where castles look like telephones, tree trunks look like cables, buds like insulators, and even the flowers remind one of mouthpieces. It is the land where school children may now go to learn about the telephone and how to use it. The journey there is via a motion picture, with the same title as this article, just made available by the Bell System as a part of a "package" of teaching materials for elementary schools.

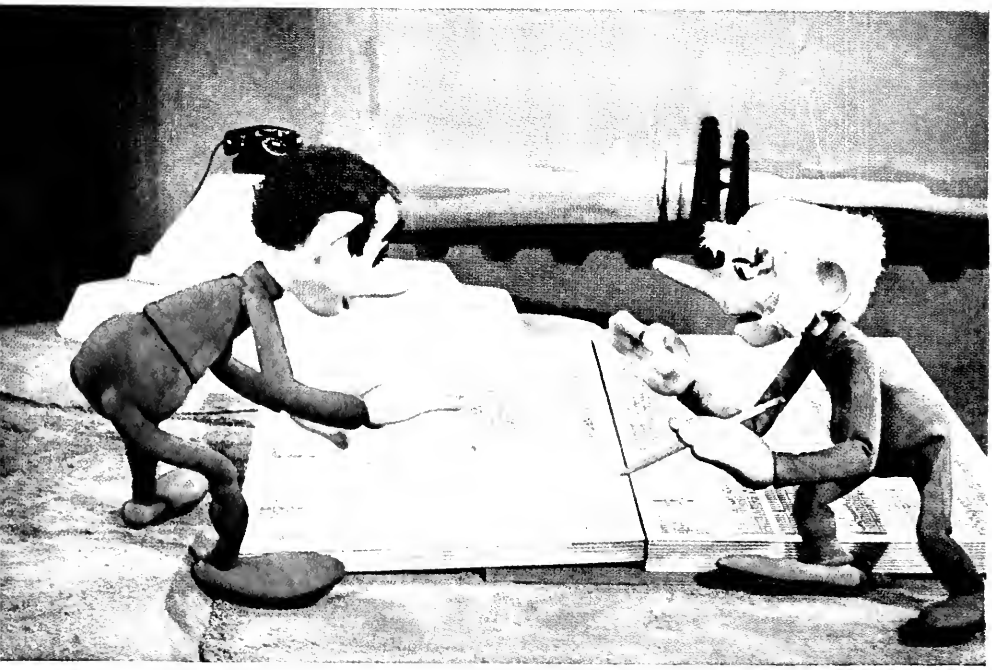
Preparation of this package is the outcome of many requests from school people for instructional material on the use of the telephone. The need was confirmed through research conducted at the request of the Bell System by a leading authority in the field of "audio-visual" education.

Besides the motion picture, the components consist of a silent filmstrip, a children's booklet, and a teacher's instructional guide. In addition, the Bell telephone companies are making available a pair of telephone instruments, and local directories, for classroom practice.

The child of today is as familiar with the telephone as are his parents. By the time he is old enough to enter school, he is rushing to answer it. The telephone habits which twenty-odd million American school children are forming today will become more fixed as they grow into adulthood. Establishing good telephone habits now, before indifferent ones become ingrained, would be of incalculable benefit to the service and to its present and future users. Teachers have said that instruction in good telephone usage is as important in preparing the child for modern life as the etiquette of writing letters.

Teaching children how to conduct themselves—over the telephone or in any other situation—is, of course, the business of parent and school. But every so often, educators have come to the Bell companies for authorita-

Bobby's friend "Handy" introduces him to the Mayor of Telezonia

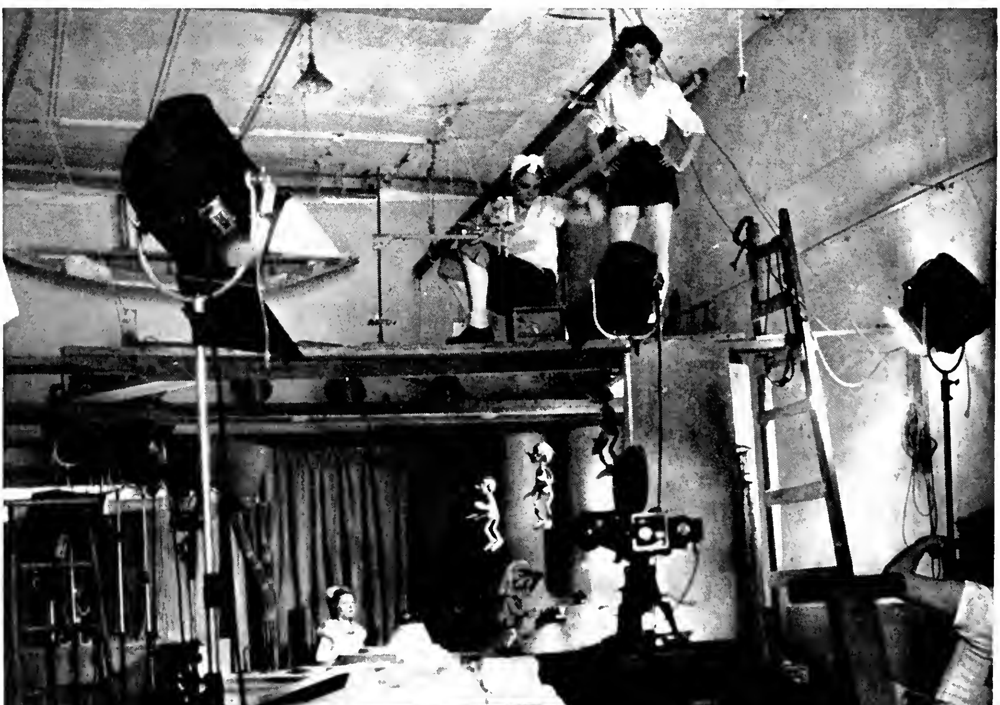

"Ready" makes sure of the right number before making a call

"Always Listen" emphasizes the importance of listening for the dial tone

The Mayor reproves "Mumble-Voice" for his failure to speak pleasantly and clearly tive material to help them do the teaching job. The companies have responded gladly with what has been available.

The Bell System has long recognized its obligation, in the interest of the best possible service, to help people use the telephone to their own and the community's best advantage. For years, good telephoning practices have been presented to adult groups in many ways: among others, through movies, booklets, talks, and voice mirror and other demonstrations. Women service advisers of the Traffic Departments regularly visit customers' switchboard attendants to help them work out the most successful methods of handling not only telephone calls but telephone callers. Commercial Department representatives and service engineers aid customers in selecting the most suitable service for their needs and in making the most effective use of it. These departments in their own fields undertake a variety of activities to improve telephone operation and use among both business and residence customers.

They have done much for the schools too. They have invited children as well as adults to visit central offices and attend open houses. Some companies have designed special demonstration equipment for class room use. Especially since the war, many Bell System films have been loaned



Setting the stage for a scene of the motion picture. The marionettes are manipulated from a scaffold above the set to schools which have asked for them either individually or for deposit in educational film libraries.

But, useful as these efforts have been, it is nevertheless the hard fact that most of the informative material available to schools had been prepared primarily for adult consumption.

Smoothing down the plastic wood head of a marionette

THE SUCCESS of films and demonstration materials in military instruction during World War II has given a new impetus to the use of these so-called audio-visual aids not only in industry but in the schools as well. Major school systems now have audio-visual departments, and several educational publications specialize in this field. Continuing demand for telephone films and other material is indicative of their usefulness to schools. But, since they were made for use with adult audiences, their treatment makes them less adaptable to the elementary grades, and school people were beginning to ask for films more closely geared to the childhood level.

The decision to honor these requests was not as simple as it might appear on the surface. School authorities guard zealously against attempts to use the classroom for ulterior purposes. In common with American industry generally, the Bell System has respected this attitude, recognizing its importance in a free society. Only on rare occasions have we sought permission to enter the schools, and then only when the requirements of the public service, such as during cut-overs from manual to dial service, suggested it.

On the other hand, many educators have felt the need for first-hand information about the complex industrial world which they are preparing the child to face. "Where can we go," they have asked, "for authentic teaching materials about industry—except to industry itself?"

If this point of view—at least as applied to the telephone industry—were as widespread as the post-war straws in the wind appeared to indicate, it would seem to be simply a matter of good citizenship for the

Bell System to give all reasonable assistance to the schools.

In considering the production of the films and other aids that the teachers were asking us for, we started from the premise that there must be unmistakable assurance that any such materials would be acceptable throughout the educational world. They would have to be wholly in tune with the policies and teaching methods of the schools. There must be nothing in them that was not dictated by the school curriculum. So, while the benefit to the telephone companies must be proportionate to what they spend for the project, this benefit must of course be secondary to the purposes of the schools.

Seeking Professional Counsel

EARLY in 1948, the Bell System sought the advice and assistance of the Audio-Visual Materials Consultation Bureau of Wayne University, at Detroit, Mich. The Bureau itself had been formed for the purpose of helping industry in preparing materials for school use. For the Bell System, the Bureau first made a preliminary study of the curricula of forty typical school systems, to find

The reaction of third graders to "Adventure in Telezonia." This flashlight picture was snapped during a showing in a Michigan public school out to what extent and at what grade levels the subject of communications is taught.

This was followed by a more intensive survey in the form of a questionnaire addressed to more than 1800 elementary public school principals throughout the United States. In essence, the questions were:

(1) Would a motion picture on good telephone usage be of value to teachers?

(2) If so, should it be sponsored by the Bell Telephone Companies and loaned free to the schools?

(3) What supplementary aids, if any, would be desirable?

(4) To what grade levels should the material be directed?

In addition, mail inquiries and personal interviews were conducted among a score of key persons in the audio-visual and elementary-school fields.

The replies to the questionnaire ran well over fifty percent—an abnormally high figure, according to the Bureau. Even more significant, ninety-seven percent of the replies to the first two questions were an unqualified *yes*. There was only one un-

A teacher discusses good telephone usage with third grade pupils

The teacher helps a pupil to become accustomed to the correct way to hold the telephone

qualified *no*. The qualifications expressed by the remaining few concerned the conditions of making the material available rather than the question of sponsorship as such.

To quote the Bureau's report: "Such unanimity of opinion from a national sampling of educators is phenomenal. It is doubtful that any such high percentage of agreement would be possible even on the most fundamental principles of learning."

As to grade level, the replies generally confirmed the Bureau's curriculum study. The greatest use for the film would be between the third and sixth grades, among children between the ages of eight and eleven.

The reason lies in modern educational methods. The subjects once known as geography and history are now approached by starting with the child's own environment. In the first grade, he learns to understand his place in his family and immediate neighborhood. This is broadened in the second grade to a further understanding of the life of the whole community. It is usually in the third year that he is introduced into the way the community uses its means of transportation and communication. It is into this "social studies" approach that material on the use of the telephone needs to fit to be most useful.

The replies to the questionnaire also showed a heavy demand for supplementary aids to the motion picture. Schools vary widely in their use of audio-visual materials. Of the 200,000 or more elementary public schools in the United States, nobody seems to know how many are equipped with facilities for showing films. Estimates range from twenty to fifty thousand and up. Schools with and without motion picture projectors make heavy use of filmstrips, which are merely a series of still pictures on a roll of 35 mm. film. These are screened from a motorless projector which is small, portable, and easy to operate.

For schools without a projector of any kind, a printed text, such as a booklet, can be useful for teaching good telephone usage. Even where a projector is available, a booklet would permit covering the subject in fuller detail through follow-up teaching and individual study.

For young children at least—and who would not say for adults as well?—the final and most important step is guided trial and practice until effort yields to habit. As walking is learned by walking and talking by talking, so talking properly into a telephone becomes natural only after the user becomes familiar with the feel of it. "At the present time," the Wayne Bureau reported, "toy telephones brought to school by the children are almost universal aids to teaching this unit of work." What better way is there to practice the use of the telephone than by having a real telephone and directory to use?

To cover adequately the needs disclosed by its research, the Bureau suggested a "package" of materials, so designed that each item could be used either independently or in conjunction with any of the others, as the teacher might desire or school facilities permit. With the survey results giving so unequivocal an answer, what to do but go ahead?

It was well that the Bureau had been first consulted, for its research had made clear the need for expert advice, to insure furnishing schools what they themselves wanted in the form they could use most successfully. The Bureau was retained, therefore, as educational adviser throughout the undertaking.

The "package" of teaching materials becomes one literally when packed in a stout carton like this

At Bell System headquarters, in New York, the Commercial and Traffic Divisions of the O. and E. Department and the Information Department worked together in drawing up an outline of the picture's teaching content. Particular stress was placed on points most pertinent to children. These included such matters as the importance of being sure of the right number through proper use of the directory; correct dialing, including listening for dial tone; what the dial tone, the ringing, and the busy signals sound like; how to give a telephone number to the operator; and, above all, how to speak clearly and courteously over the telephone—with special emphasis on party-line neighborliness.

This information was given to a scriptwriter, Mrs. Ruth Snow Burns, experienced in film-writing for children. It was also used as a basis for the script of the filmstrip prepared by the Wayne Bureau, and for the children's booklet and teacher's guide produced by the Bell System.

A Boy and his Dog

TELLING the motion picture story through marionettes—with their perennial appeal to all ages—was a "natural." Bil Baird, who had made the previous Bell System marionette film, "Party Lines," was engaged as producer.

The motion picture, in 16 mm. color and running 18 minutes, took shape as the story of Bobby, a boy who loses his dog Bounce. In his excitement, Bobby fails to use the telephone correctly and attracts the attention of a gnome, Handy, who offers to help. Bobby is transported to Telezonia, where the gnome inhabitants help him find his dog through correct and courteous use of the telephone.

Handy himself, with receivers for ears and antenna for a hat, assembles the citizens as the Mayor, wearing an insulator as his cap of office, keeps a fatherly eye on the proceedings. As each gnome takes his turn in trying to locate Bounce, Handy points out to Bobby what is right or wrong about their use of the telephone. There is the energetic and efficient Ready, expert in the use of either dial or non-dial telephones. His friend, Always Listen, appears at dial telephones to remind us to listen for the dial tone. An elderly, meticulous directory gnome looks up telephone numbers with the gravest of care to get the right one. The indistinct speech and bad manners of Mumble Voice defeat his eagerness to help until the Mayor intervenes. And there is the little girl gnome who is always polite to others on her party line, despite her distress when her attempt to find Bounce is delayed by long-winded Party Line Piggy. The final call that locates Bounce is made successfully by Bobby himself.

The filmstrip, "How We Use the Telephone," with fifty-two pictures in color, uses some of Telezonia's characters, but is not a still version of the motion picture. It is a teaching medium—and an important one—in its own right. One of its advantages is that it lends itself readily to class participation. For example, a close-up of a dial with the captioned question, "How would you dial SOuth 9–9076?" encourages the child to step to the screen and demonstrate to the class. Another picture asks,

Above: Cover and one page from the teacher's guide. Right: The children's booklet

"Which one of these girls is holding the telephone correctly?" for the class to volunteer the answer. In this way, and point by point, it illustrates each of the principles of good telephone usage.

The children's booklet, "The Telephone and How We Use It," explains the use of the telephone and directory in greater detail and with profuse illustrations. The back pages are devoted to a series of classroom exercises, with a sheet on which the child may early establish the habit of keeping his own personal telephone number list.

The teacher's manual, "A Guide for Teaching Correct Telephone Usage," deals separately with the use of all the materials in the "package" to achieve fullest teaching effectiveness. It contains, in addition, some general background information about the telephone, and a bibliography of reference material.

Pre-test Results

BEFORE the cameras were to turn, it was decided to pre-test the material, to make sure that content, vocabulary, and pace were suitable to the third-grade level. Drafts of the scripts, booklet, and guide were distributed for comment by the Wayne Bureau among a hundred or more teachers and audio-visual experts. The motion picture script was recorded on a disc and rough drawings of each scene were put on a strip of film. These, along with drafts of the children's booklet, were taken to a number of classrooms and teachers' groups in the Detroit area. While still in this rough form, it was clear that the children liked the story and understood its message. Even third graders could read and understand the booklet.

Meanwhile, at the Baird studio, in New York City, the sets were being built for the imaginary land of Telezonia. The heads of the marionettes were fashioned at first in clay, from which plaster casts were made. Into these was poured the plastic wood of the final product. For Handy alone, four separate heads had to be designed, each with a different expression and mood. Movable eyes, brows, and chins were slipped into place and wired to the manipulating strings. Hands were carved from wood, each with a different gesture.

A good part of 1949 was spent on all phases of production. From the scaffold above the studio stage, the Bairds pranced their puppets to the camera's rolling tune. Stills were photographed for the filmstrip. The booklet and guide approached their final form.

As soon as first copies of the material were ready, the complete product underwent the same testing as the first drafts, in about a dozen classrooms and in several teachers' groups. Bell System Commercial and Public Relations people attended some of the tests, observed the children's intense concentration on the puppets of the screen, and listened to their answers to the teachers' questions.

There was no doubt that these children—whether of the third or the sixth or even the eighth grade—enjoyed the experience and remembered what they had seen. Teachers were asked, therefore, whether enjoyment of the story might overshadow its teaching value. The unanimous opinion was that the one served only to enhance the other.

It was equally evident that the package would fulfill these teachers' needs. Several commented that it would be useful, beyond its immediate purpose, for teaching such unrelated subjects as spelling, vocabulary, English composition—and even drawing, for which the marionettes could serve as models.

The package was released early in 1950 to the Bell companies, which are announcing it and making it available to schools. Since this is a new venture, many unusual and challenging problems of distribution need to be overcome. Procedures vary among school systems for putting instructional materials into the hands of teachers. Plans are already being made to work out with school authorities the most effective and economical means for distributing the material to all schools that may want it—including those in the territory of non-Bell telephone companies.

Some two million children in American elementary schools pass through one grade each year. The great majority of them are not only tomorrow's telephone users but today's. It is too early to predict how many school children will take the journey to Telezonia, or the influence it will have. The degree of its success rests with its acceptability to the schools, and their experience with it. It is hoped that some schools will be interested in using measurement techniques to find out whether, what, and how much children learn and retain of its message.

At any rate, the venture of "Adventure in Telezonia" will bear watching for the sake of the future telephone habits of America. For it is today's young Americans who will be the chief beneficiaries of a more pleasing and more valuable telephone service, to whose improvement they themselves will have contributed an important share.

This Magazine on Microfilm

An agreement has been entered into between the American Telephone and Telegraph Company and University Microfilms to make the Bell Telephone Magazine available in microfilm form. Microfilm makes it possible to produce and distribute an entire volume of a periodical on a single roll of film. The microfilm is on positive film, and is furnished on metal reels, suitably labeled. Inquiries concerning microfilms of the Bell Telephone Magazine should be addressed to University Microfilms, 313 N. First Street, Ann Arbor, Mich.

A Better Plan for Christmas Traffic

Lowell F. Wingert

Another chapter can be added now to the article by Cyril K. Collins entitled "Merry Christmas in the Toll Offices" which appeared in the Spring issue of this Magazine a year ago. It concerns a new plan used last Christmas, following a satisfactory trial on Mother's Day, in a further effort to complete the greatest possible number of holiday calls with facilities which cannot be expanded sufficiently to absorb the enormously increased volume of long-haul switched calls offered on this one day of the year.

Completion of calls was improved an average of about five percent in the System, with Long Lines messages as much as 14 percent higher in 15 representative cities. Fewer delays were posted, and those of five hours or more were reduced about 30 percent from a year ago. Credit also is due to other factors, such as a slight reduction in volume together with a small increase in circuits, a fine performance by the No. 4 operator toll dialing equipment, and improved operating experience. These, and a new practice, contributed to the most satisfactory handling of Christmas traffic in a number of years.

The Traffic Department describes the new practice as the "circuit division plan," and it was designed to "divide and complete"—to paraphrase the familiar military axiom of "divide and conquer." Its primary purpose is to relieve the congestion occurring in the largest switching centers in the System.

Fifteen of these cities—New York, Chicago, St. Louis, Atlanta, Pittsburgh, Detroit, Minneapolis, Denver, Omaha, Dallas, Cleveland, Boston, Kansas City, Newark, and Washington, D. C.—were selected by the Operating Companies as the primary switching centers needing the most relief. Under the division plan, these were designated as "Group A" cities. Twenty-six smaller cities, known as secondary switching centers, and all Pacific Company cities with transcontinental circuits to eastern terminals, were known as "Group B" cities.

All circuit groups between "A" offices and those between "A" and "B" offices were divided directionally on a 50–50 basis. For example, if there were 10 circuits between two of these cities, they were divided so that each had five for their own exclusive use. Any odd circuits were given to the office appearing first in an alphabetical list.

All other cities in the System, however—and this is the significant factor—divided their circuit groups with "Group A" cities on a ⅔–⅓ basis, with the "A" switching center using the larger portion. Such a division has the effect of holding back the traffic, to some extent, at originating offices instead of allowing it to pyramid at the large switching centers. At the same time, by providing additional circuits—two-thirds of a group—for the completion of through calls in "Group A" cities, more calls could be switched through these centers without delay—thereby reducing to a considerable extent the usual Christmas "bottleneck."

In addition to the primary advantage of a reduction in delays at the switching centers, several other important advantages were achieved with the plan. Traffic forces generally reported that the circuit division eliminated much waste circuit time ordinarily caused by operators challenging each other for the use of circuits. This practice, only rarely required under normal operating conditions, is effective, but it is time consuming and wasteful under extreme holiday overloads. Also, any considerable amount of challenging for circuits adds noise and confusion to an operating room. Chief operators commented that much quieter and more efficient operating conditions were experienced than on previous Christmas days.

Of considerable importance was the added advantage that the circuit plan utilized normal every-day operating practices, thus eliminating the need of training thousands of operators in special holiday methods, with an attendant loss of operating efficiency.

Instructions concerning all groups to be divided were furnished to those concerned by November 15, thereby allowing adequate time for preparation. Actual divisions were made not later than 4 P.M. on December 24 in all offices, in order to be ready for the Christmas Eve rush. In most cases, circuits were divided without the necessity of a telephone call between the terminal offices affected. Considering the large number of circuits which were divided, and the numerous offices in the plan, the division was remarkably effective. The Plant forces played an important part in handling the equipment phases of the division, and the Commercial Department assisted greatly in the arrangements made with the independent companies which participated in the plan.

Aggressive efforts are being made to find still better methods for handling the Christmas traffic peak. Two modifications in operating practices, which it is hoped will result in still more effective use of circuit time are being tried on this Mother's Day.

1. Reduce the interval of time which circuits may be held at the second switching office or beyond, when no-circuit conditions are encountered.
2. Extend the time interval before leaving an order for a circuit at the first switching office when a no-circuit condition is encountered. During this additional period, operators at the originating offices will make additional attempts in an effort to complete these calls.

It is hoped the results of these trials will turn out to be helpful material for another chapter in the continuing story of Christmas service improvement.

Twenty-five Years Ago in the

Bell Telephone Quarterly

Items from Volume IV, Number 2, April 1925

The Recent Solar Eclipse

When the eclipse of the sun swept down from Lake Superior toward New York City on January 24, 1925, and then out across the Atlantic, many engineers of the Bell System were at specially assigned posts within and near the path of totality to note any anomalous behavior of radio waves or of grounded telegraph lines. At the request of the American Astronomical Society, the American Telephone and Telegraph Company, through the Long Lines Department and through the Bell Telephone Laboratories, loaned facilities to assist in obtaining scientific information regarding the eclipse, the present eclipse having been unique in that it passed over territory exceptionally well provided with communication facilities. The use of long distance telephone and telegraph circuits enabled the observing astronomers to time more accurately both the eclipse and their photographing of certain details, such as the flash spectrum.

Progress in Telephotography

On April 4, 1925, the American Telephone and Telegraph Company inaugurated a limited service for the transmission of pictures over long distance circuits between New York, Chicago, and San Francisco, following three successful demonstrations during the preceding month of the method developed by Bell System engineers.

The first of these demonstrations was held March 1, when three test pictures were transmitted from Washington, D. C., simultaneously to New York, Chicago and San Francisco, and there distributed to the press. The second was on March 4, when nine news pictures of the Inauguration of President Coolidge were transmitted to New York, Chicago and San Francisco. The third was on March 19, when, without previous preparation, a dozen good news pictures of tornado damage in Illinois and Indiana, offered by various pictorial news services, were sent from Chicago to New York and San Francisco.

The first picture of the Inauguration of President Coolidge, that of the floral tribute to Mrs. Coolidge presented by ladies of California, was started on the circuit from Washington at 10:22 a.m., Eastern standard time. Extra editions of newspapers carrying this picture were on sale in San Francisco before 11 a.m., Pacific standard time, and in Chicago at about the same time. In all, nine official pictures, including one of the administration of the oath, taken from a distance of about 125 feet, were transmitted up to 5:45 p.m. From 25 to 40 prints of each picture were made at New York and Chicago and about 100 of each at San Francisco and furnished to newspapers and others for reproduction. Practically all the principal daily papers in the three receiving cities used the pictures, in some cases several being used on a display page. In some instances, enlargements to four and five newspaper columns in width were made and printed with good results.

Noticeable improvement in the quality of the photographs transmitted is noted as a result of several months of continued experimentation and refinement since the initial demonstrations in 1924. Comments of many representatives of the press were to the effect that the pictures now being transmitted are commercially satisfactory and that the system now being offered for commercial use in New York, Chicago, and San Francisco is a practical solution of the problem of rapid and dependable telephotography.

Breaking New Ground

From the A. T. & T. Annual Report for 1949

TELEPHONE SERVICE today is generally as fast, clear, accurate and dependable as at any time in history and the Bell System is breaking new ground in service betterment.

It is fundamental in the policy of the business that the only good service in the long run is one that is always improving. We expect to go forward in the years ahead as we have in the years gone by. Bell System research was never more effective than it is today. Bell System manufacturing, supply and service operations were never better performed. The men and women of all departments are doing a magnificent job and the facilities they design, build and operate are far and away the best in history and getting better every day.

We are confident too that telephone users desire good and improving service and prefer to pay what it reasonably costs. We believe the public understands the need for good telephone wages and working conditions—for a sound financial structure—and for earnings that will continue to provide a steady and reasonable return on the billions of dollars invested in the Bell System by hundreds of thousands of men and women. We have confidence that under wise regulation, in future as in the past, the System will continue to have the means and the freedom it needs to do the best job that it can.

Those are cornerstones in the building of a communication system that is a great national asset. The character of the organization is in its full acceptance of the responsibilities entrusted to it. It is in the knowledge and skill that the Bell System has gained and is constantly increasing. It is in the desire of telephone people to serve with friendliness and courtesy and cheerful will to get the message through. All of these things are as real as the ring of the telephone bell. They are found alike in "the voice with the smile"—in the mind and hands of the craftsman—and in the consideration of every problem of policy. They mean that the Bell System can be relied on to move steadily forward in providing better and better telephone service to the American people.

Who's Who & What's What

(*Continued from page 3*)

the engineering and field tests of just about all types of carrier systems, the toll office terminals of local dial systems, and inter-toll dialing systems. He has been Engineer of Equipment and Buildings of the Long Lines Department since 1943, and has had supervision of the design and engineering of the buildings for broad band carrier projects and radio relay. Along with that has gone the engineering of equipment installations associated with those undertakings and for the operator toll dialing program.

THERE ARE MANY little-known aspects of the widely ramified telephone business, and one of them is the extensive part which the Bell System plays in "PBX" service. LEWIS M. FUEHRER and GLEN WHITEMAN combine in describing certain engineering and personnel activities which are basic to a successful program.

Mr. Fuehrer began his telephone career in New York in 1921, when he joined the Department of Operation and Engineering of the A. T. & T. Company. For five years he was engaged in handling traffic engineering problems relating to various types of central office switchboards. In 1926 he transferred to the Southern Bell Telephone and Telegraph Company, where for two years he worked on inter-office trunking arrangements for local and toll switchboards. He returned to A. T. & T. in 1928, and has since been busy designing more efficient PBX and order turret facilities and preparing standard traffic engineering practices for uniform System-wide application.

Mr. Whiteman began his Bell System career with the Southwestern Bell Telephone Company in 1910, and held traffic assignments there and with the Long Lines Department and the New York Telephone Company before joining the traffic results section of A. T. & T. Company's O. & E. Department in 1922. For the past 20 years he has had to do chiefly with activities which help PBX customers in the operation of their switchboards. During World War II, an important customer was Uncle Sam, and Mr. Whiteman spent several busy years assisting the Associated Companies in organizing and operating PBX service at Army camps throughout the country. Hence came his "Operating Army Switchboards" in this MAGAZINE for June 1943.

LeRoy A. Born

Lowell F. Wingert

LeRoy A. Born began his Bell System career as a contract agent with the New York Telephone Company in Syracuse in 1922. Subsequent experience included commercial and sales training and sales and servicing work. In 1944 he transferred to the Information Department of the A. T. & T. Company, where he is engaged in film and display work. Here he has guided and coördinated all phases of the "Adventure in Telezonia" project. His interest in the educational value of motion pictures is understandable in the light of a youthful two years' experience as a teacher in a "little red school house," a B.S. degree in education *summa cum laude*, and membership in two honorary educational societies.

The Christmas traffic situation, one of the most stubborn operating problems in the Bell System, is yielding to patient study and intensive effort, and Lowell F. Wingert supplements Cyril K. Collins' "Merry Christmas in the Toll Offices" of a year ago with a briefer report of improvements achieved. Joining the Northwestern Bell Telephone Company in 1934, Mr. Wingert transferred to the Long Lines Department in Chicago ten years later, and subsequently served as force adjustment supervisor in New York and as district traffic superintendent in Memphis. In 1948 he returned to New York to become a member of the Traffic division of the O. & E. Department of the American Company, and was assigned to force adjustment matters. For the past year he has been head of a group handling toll and teletypewriter service results.

What It Means To Be *Telephone* People

We telephone people travel an unusual road.

In a nation where big business and little business drive down a fast, competitive highway, we have been leased a private way. To us the people of the nation have singularly granted a trust and a power.

In the Bell System there are more than half a million of us, serving twenty-five million customers. On our shoulders alone is the responsibility to give these people the round-the-clock, dependable telephone service they need. In our hands is a power to bind them together in friendship, trust, and common understanding.

Over our switchboards go their hopes, their fears, their sorrows, their needs. Across our lines they order groceries from the corner store, close business deals, make appointments, send tidings of births and deaths. With our help they summon doctors when they're sick, policemen and firemen when they're in trouble. We have taken part in the shaping of the law, the progress of commerce, the growth of schools, and the courtship and marriage of two generations.

Since the birth of the industry, telephone men and women have dedicated themselves to the fulfillment of this—our public trust. They have developed within themselves and the telephone team a spirit of service and helpfulness that has surmounted fire, flood, and disaster. They have handed down to us a heritage rich with their courage, their loyalty, and their devotion in rendering a service to the people.

We, the telephone people of today, are vested with the responsibility of carrying on this trust. We will make mistakes, for it is human to err. But in the long run, how we do our individual job, how we bear our individual responsibility, will determine how we achieve our trust. For in the last analysis we do not work for the telephone company. We *are* the telephone company.

—*Adapted from a leaflet distributed to its employees by the New England Telephone and Telegraph Company.*

The Bell System Tax Bill

TAXES on Bell System telephone service in 1949 amounted to nearly $800,000,000. This is about $100,000,000 more than the 1948 tax bill and is equal to more than $2 a month for every telephone in service.

Federal excise taxes paid by customers in 1949, and remitted by the Bell Companies to the United States Treasury, came to about $445,000,000. Taxes imposed on the Companies (but also paid by customers in the final analysis) were $346,144,000. In connection with increases in telephone rates, it may be noted that for each $1.00 in additional net revenues, the Companies must charge telephone customers $1.61 to offset the additional Federal net income tax, which is at the rate of 38 per cent. In addition, the customer pays a minimum of 15 per cent for excise taxes, or 24 cents more for a total of $1.85. Of this, the Government receives 85 cents and the Company $1.00.

The present high excise tax rates are a carry-over of wartime restrictions and have no place in the peacetime economy. They discriminate against users of telephone service, as they saddle on them too great a portion of the total tax load. We therefore believe they should be abolished as soon as possible. If they cannot be abolished completely, the first step should be to eliminate the taxes on local telephone service and on toll messages of less than 50 cents, and to reduce greatly the tax rate on other toll messages.

From the A. T. & T. Annual Report for 1949

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Summer 1950

A Medium of Suggestion & a Record of Progress

Published for the supervisory forces of the Bell System by the Information Department of American Telephone and Telegraph Co., *195 Broadway, New York 7, N. Y.*
Leroy A. Wilson, *President;* Carroll O. Bickelhaupt, *Sec.;* Donald R. Belcher, *Treas.*

Who's Who & What's What *in This Issue*

The Bell System career of Leroy A. Wilson, who became President of the American Telephone and Telegraph Company in 1948, is given in some detail in our preceding issue (Spring 1950), which carried his statement to stockholders at the annual meeting, under the title of "Events of Great Magnitude in This Business."

In expressing appreciation of the hospitality which A. T. and T. stockholders showed when "they allowed us to visit them and talk with them," C. Russell Deyo speaks not only for himself as author of "Here Are the People Who Own This Business," but for the members of the Public Relations Departments throughout the Bell System who actually made the interviews—displaying, obviously, a combination of friendliness, courtesy, and tact which won the confidence of a wide variety of people.

Mr. Deyo joined the Bell System in 1941 as a staff writer in the Public Relations Department of the Western Electric Company. He later worked in the Personnel Department, and became editor of *The Observer,* a monthly publication for members of Western's Installation Department. War took him into the Navy, and he became skipper of one of the fast and scrappy little PT boats in Philippine waters. In 1946 he joined the Public Relations Department of the New York Telephone Company, and since last year he has been editor of its employee magazine, *The Telephone Review.*

A teacher and professor of mathematics for ten years before World War I, Donald R. Belcher joined the A. T. and T. Company in 1919, and was appointed assistant chief statistician in 1927. Upon his return from Government service in in World War II, he was appointed assistant comptroller in 1943, and was elected Treasurer of the A. T. and T. Company in 1944.


Leroy A. Wilson


C. Russell Deyo


Donald R. Belcher

Leslie R. Johnson

Clarence W. Foss

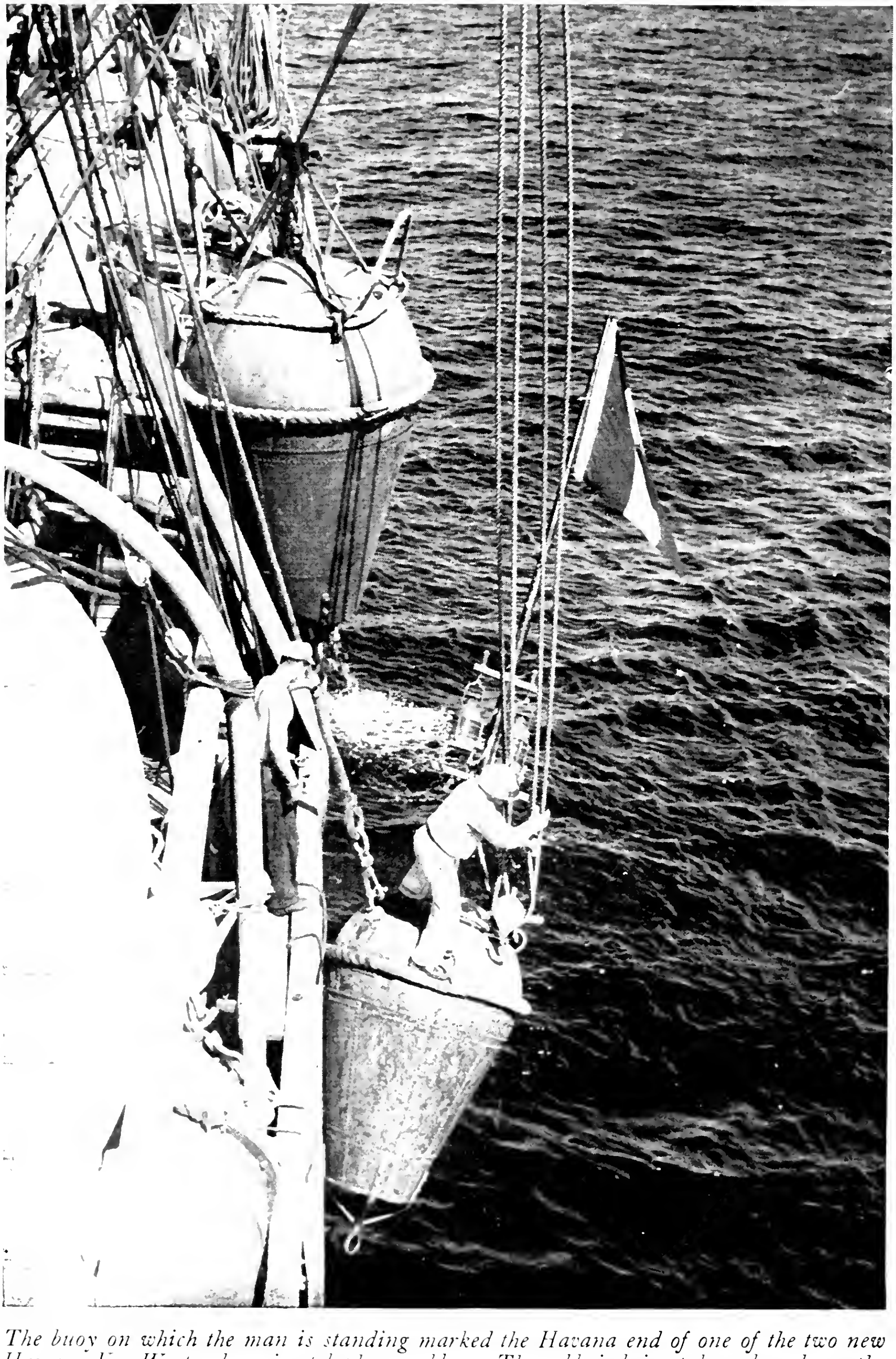
James M. Clark

A member of the Army with service in the A.E.F. in the First World War, Mr. Belcher served the Navy in the Second World War as Chief of Planning and Statistics and as Navy Material Control Officer, and for his war work was awarded the Medal for Distinguished Civilian Service by the Secretary of the Navy in 1944, and in 1947 received the Presidential Certificate of Merit. He is active in various civic and professional organizations and is a member and fellow of a number of mathematical and allied scientific and learned societies.

When the final splice was made and the cable was committed to the deep, Leslie R. Johnson was among the group on the *Lord Kelvin* who heaved a sigh of relief and drank a toast to the success of the undertaking—as he describes in "New Voiceways under the Gulf Stream." Joining the Long Lines Department of A. T. and T. in 1928, he had a short assignment in Cleveland, O., and then headed east to the Engineering Department in New York. Here he worked on telephone facility planning and on studies such as the early coaxial cables and the first transcontinental cable. A staff assignment in 1940 dealing principally with overseas radio service arrangements was followed by a four-year tour as division plant engineer at St. Louis. He came back to Engineering in New York, serving as facilities engineer and then as plant extension engineer, and early in 1950 became engineer of outside plant—just in time to witness much of the actual construction of the Havana-Key West submarine cables, after having assisted in earlier studies of them during previous assignments.

The annual "Telephone Statistics of the World," which is compiled and published under the general direction of Clarence W. Foss, of the Chief Statistician's Division of A. T. and T.'s Comptroller's Department, receives world-wide recognition as *the* authoritative statement in its field. Very few people—outside of those engaged in the task—know about the detailed census of telephone development in the United States which is compiled at five-year periods under Mr. Foss's direction. The historical background of this "count," and its special usefulness, are the topic of "Keeping Tabs on All of This Country's Telephones." Mr. Foss joined the New England Telephone and Telegraph Company in 1914. Six years later he transferred to the Chief Statistician's Division of A. T. and T., where he is in charge of both United States and foreign telephone devel-

(*Continued on page 132*)



The buoy on which the man is standing marked the Havana end of one of the two new Havana–Key West submarine telephone cables. The cable is being taken aboard over the bow sheaves of the cable ship Lord Kelvin for the final splice. *See "New Voiceways under the Gulf Stream," beginning on page 102*

The Head of the Bell System Discusses Some of the Ways In Which Individuals Are Encouraged to Develop Their Full Capabilities for Responsibility and Leadership

Helping People to Do Their Best

Leroy A. Wilson

The following is from an address given before the National Editorial Association on June 17, 1950. EDITOR

IT IS the historic American idea that every individual has his own personal rights and needs, which must be respected. This is a great political idea, and the basis of the freedom we enjoy as citizens.

It is also an idea of fundamental importance to industry and to our national economy. For the fact is that people in industry can develop their personal resources, and grow in stature and ability and courage, only if their human worth as individuals is respected and encouraged. Only if you and I treat the other fellow with consideration and respect is he going to feel his personal and social responsibilities, and accept and carry out his obligations not only to the business that employs him but also to his family, his community, and his country.

This movement toward better human relations in industry is of the greatest possible importance to all our future progress. It's an essential part of the process of enabling individuals to be self-reliant. The news these days is full of words like "security" and "the welfare state." A lot of us are concerned about the growth of the idea that security is something to be had for the asking. It isn't. But if business and industry do not treat men and women as individuals, we shall not only be discouraging their will to make the most of themselves—we shall actually be encouraging them to depend on somebody else. To put it bluntly, we'll be lending the greatest assistance toward arriving at a welfare state, without in many instances having the slightest realization that that is what we are doing.

Let's not do this. Let's do it the other way. Let's encourage every person we know to give the best he has and to stand on his own feet. And let's start by recognizing him for the individual human being he is. That way lies real hope for the future.

Helping People to Better Understanding

A SECOND AVENUE for progress, it seems to me, is through helping the individual to gain a better understanding of how this nation and its standard of living—highest in the world—developed, how his community functions, how his company operates, and what it all means to him.

Millions of people today don't have much understanding of how our economic system works. I doubt if they will get it if we limit ourselves to teaching Economics with a capital E, in an academic sort of way. But most people are interested in their own jobs, their own livelihoods, their own personal opportunities to live comfortably and to satisfy their own ambitions. Plain talk about the economic facts of life in *your* company, and what they mean to *you*, is going to get your attention. And I don't think I am being unduly optimistic in believing that if the educational job is well done, in the long run it's going to get understanding and cooperation as well.

Another point I might add here is this: business men generally are aware of the challenge. Now that they are, let's do the work where it needs to be done—that is, with our own employees. That's where we are doing it in the Bell System and we're going to keep on doing it.

Such an educational job is not only good in itself but it can also help to develop the self-reliance I mentioned a moment ago. For example, all over the Bell System frequent meetings are being held by our management people—department heads and division and district managers and others. They are discussing the important facts about our business with the people in their organizations. However, using cut and dried material is carefully avoided. We want each person to develop his own approach, for in doing so he develops himself. Sometimes this takes a little longer, but we think it results in better informed people and more effective education.

JUST TO GIVE YOU an idea of a typical subject and one possible approach—take the subject of telephone rates and earnings. Here we can start with a few outstanding and fairly newsy facts. One is the fact that during the last five years we have had to meet the greatest demand for service in history during a period of rising prices. We've added more than 12 million telephones and expended nearly five billion dollars for construction, most of which has come from investors. Each new telephone we put in costs a lot more to install than a telephone that was put in a few years ago; and with wages about doubled and other expenses much higher, every telephone costs more to operate. So, to meet the expenses and pay a reasonable return to those who have invested in the business, we have had to ask for increases in telephone rates.

But—and here we come to some interesting points—those increases average less than the increases in the cost of most other things: less than the rise in family income levels, much less than the rise in telephone wages alone. Now why is that? Is it because all of us in the telephone company are finding better ways to do our jobs? Is it because we have better equipment and tools to work with? Is it because we never let up in our program of telephone research? And—getting right down to the individual—doesn't this sort of progress, based on the combination of reasonable earnings and the continuing effort to give better service, offer the best assurance of continuing opportunity for him?

Those are just a few of the questions that can be discussed around one topic. There are plenty of other topics, plenty of ways to present them, and plenty of reasons for doing so. Surely there is no better way to gain in economic understanding than to learn the fundamentals of how your own company operates.

After all, a good time to be learning the principles of how you make a living is when you are actually earning one. Because learning helps doing and vice versa. You don't just hear about your subject—you can touch it and taste it and feel it. While we have a long way to go along this road in the Bell System, I think there's a green light ahead to real accomplishment.

Organizing People as Teams To Meet Problems

The third field I want to explore a little is the organization of people to meet their problems as teams working together. Of course every business has its own problems, so I shall limit myself to telling you how we in the Bell System have organized to meet some of our own.

Here are a few of the fundamental questions:—

How good and how much better can we make the quality of telephone service?

How can we best assure careful selection of people and effective training? And able supervision? And the continuing emergence of capable managers and executives from the ranks?

Also—and particularly in a business like the telephone business, which is a monopoly by its very nature—what furnishes the incentive to do a better job? How can we keep people at all levels of the organization vigorous and alert? Whence comes the vitality that is required to discover and realize opportunities for progress?

In sum, what makes you do what you ought to do and how do you find and develop the people who are not only anxious but able to do it?

I told you those were going to be fundamental questions. Now for what seem to me to be some of the fundamental answers.

The first is that when you give people responsibility, you also give them the authority that goes along with it. You really decentralize. We have carried that a long way and it is invaluable.

Each Company of the Bell System, for example, has its own Board of Directors, to which its president is responsible. Furthermore, the large majority of these directors are non-telephone people. And in all the Companies the non-telephone Board members are local men of varied experience and outstanding abilities who know the area and whose judgment contributes a great deal to the handling of local telephone problems. In a very real sense, they represent the community the company serves.

All told, the directors of the Bell Companies number more than 280, of whom, as I have said, only a small proportion are Company officers. And although the Bell System is a unified organization rendering an essential integrated nation-wide service, at the same time leadership and responsibility and authority for local operations are shared by able men of broad experience outside the telephone business. I don't think there is any exactly comparable arrangement anywhere in American industry.

The Sense of Personal Responsibility

THE SAME PRINCIPLE of decentralization carries down through all levels of the organization. To the fullest possible extent, every person charged with a job is really made responsible for doing it—which means that he or she has to have the necessary equipment, including training, tools, knowledge, brains, and authority. The operator who handles your call, the installer who installs your telephone, each is given and accepts a real sense of responsibility for your service. We all know it as "the Spirit of Service," meaning the spirit that encourages people on their own initiative to add plus value to the service.

For example, let me just mention something that happened recently in the town of Lockhart, Texas. One of our customers there had to carry on his business from a bedside telephone while he was getting over a long illness. He got such friendly coöperation from the operators that when he had fully recovered he and his wife came over to the telephone office—with a big home-made cake for the girls. Everybody had a good time, with cake, coffee, conversation, and a little trip behind the scenes of the exchange for our friends and visitors so that they could see how the local telephone system worked. That is the sort of atmosphere that grows out of the spirit of service and the sense of personal responsibility.

Here is another illustration of the same kind of spirit. A woman in Cincinnati called the telephone business office not long ago to ask to have her telephone disconnected. It seemed that she had tuberculosis and had to go to a sanitarium. Then it also came out that she was a widow with two little girls who were going to a children's home until she was well enough to earn their living once more. What happened next was that the girls in the business office decided that they wanted to take part in caring for the children while their mother was ill. And recently they received a letter from the children's mother in which she said, "I have lost much, but I have gained more—I have found friends."

Naturally, things like that don't happen every day. But if one thing doesn't happen another will. My point is simply that there is a wonderful spirit in most people and it comes out best when you give it room.

THE LAST POINT I have in mind is the measurement of results. This is tremendously important. While responsibility and authority are delegated locally, uniform standards are set up and performance is measured against them. Then the results everywhere are analyzed, so that everybody in all parts of the country can study them. The manager in one town can see how his results compare with the results obtained in other towns all over the district. District managers likewise compare their results with other districts, division managers with other divisions, and so on.

Of course you realize what this means. It means that along with decentralization we have intense competition—between exchanges, districts, divisions, areas, and finally between companies. And this competition *within* a business that by its very nature has to be a monopoly is just as keen as or keener than anything I know of in any industry. We use constant measurement—not only as to technical performance, but also as to skill in handling human relationships—to keep it going strong. Then we lift the standard from time to time and keep on measuring.

Encouraging Initiative and Leadership

You can see how this process encourages initiative. It facilitates the search for people who can take more responsibility. It brings to the forefront the people who by common consent have shown their ability. Another factor is that we have a pension plan that provides for the orderly retirement of the older people. This insures continuous movement in the organization and, thereby, continuous opportunity for unusually able people to make a bigger contribution to the business and continuous incentive to the younger group.

On the whole, I think these principles have served us and the country well during these strenuous times. We have been facing a wide range of problems on many fronts—problems more numerous and in most respects more exacting than those of the past. And while we certainly are far from having solved them all, I think we have made progress and I know we are going to keep on trying. I don't say this in order to take credit for the Bell System. The point is simply that we are part of America, and all my experience strengthens my faith that Americans are going to cope successfully with the problems of the future, whatever they may be.

After all, we have the finest spring to draw from that I know of. I mean our freedom—our freedom to think, to learn, to judge, to grow, to preach and teach and act—our freedom to develop within ourselves, with all the encouragement that our fellow citizens can give us, the qualities of leadership.

And in the years ahead we shall need more leaders in this nation rather than fewer, more rewards rather than less,—more incentives, more opportunities, more encouragement to those who have the capacity and willingness to pick up the ball and carry it far. In business management today there is no more important single problem than to develop and hold the future leaders who can be depended on to manage business well and guide it to greater achievement. And this is true today not only in business but in every other phase of our national life. What makes a country great is freedom and big people.

Meet Some of the Men, Women, and Children—Close to a Million in All—From All Walks of Life, Who Hold Stock In America's Largest Single Enterprise

Here Are the People Who Own This Business

C. Russell Deyo

YOU SEE THEM every day: in city streets, on country roads, in offices and homes, in factories and fields, over the length and breadth of the land. They are everyday people, in every walk of life. And yet—there's something special about them, too. For they own the largest single enterprise in America.

Through the savings which they have invested in the stock of the American Telephone and Telegraph Company, they own millions of miles of cable and wire spanning the mountains and plains of the nation, radio transmitters that send voices vaulting across the seas to other lands, switchboards in great cities and hamlets from Maine to California, and all the endless variety of plant it takes to bring telephone service to America's millions.

It is a business that serves the people of America and, more than any other enterprise, it is owned by the people of America—970,000 of them. Families throughout the land —about one in every fifty—share in the ownership of the Bell System.

You can't recognize the owners of the Bell System when you meet them. They wear no distinguishing mark. Yet you'd like to know some of them—see what they are like?

Well, come and visit a few of them. Let's travel with the dawn as it comes winging out of the gray Atlantic, westbound at a thousand miles an hour. It touches the rugged New England coast, then slips swiftly south, down the shoreline's giant toboggan slide, driving the night before it.

IN THE little seashore town of Kingston, Mass., people soon are stirring, among them August and Mary Sundquist, who live in a small, comfortable house on tree-lined Maple Street. They built their home 22 years ago,

Mary and August Sundquist

and somehow its hedges and vine-shaded porch suggest the serene happiness which they have found there.

Before he leaves for his day's work, in the nearby cranberry bogs or—some days—as a gardener around the shore's summer homes, August Sundquist, a man entering his sixties, enjoys stepping outside and listening to the songs of the birds which he and Mrs. Sundquist feed so frequently. They are old friends, and the Sundquists rarely fail them. Many of the birds never leave for other grounds, even in winter.

Indoors, Mary Sundquist busies herself getting breakfast, while two cats watch with somber eyes. Their names are Betty and Bobby, and like most pets they're a little spoiled. They love fresh haddock, "so it's fresh haddock they get," their master observes briefly.

If a New Englander is thrifty, then the Sundquists are staunch New Englanders, for everything they own has come from their thrift over the years. When they discuss their modest investments, August Sundquist, not a man to waste words, nods at his wife and admiringly remarks, "She did it."

For it was 25 years ago when Mary Sundquist, then Mary O'Sullivan, took some money that she had saved after working a number of years and bought the first shares of the A. T. & T. stock which she and her husband now jointly own. "The dividends we have received have meant a lot to us," she says earnestly.

WHILE the Sundquists talk, morning slips across the spires of Manhattan, southwest 200 miles, and the big city slowly begins to rouse itself.

In vine-covered Whittier Hall, on the campus of Columbia University, Ellen Bradley is soon up and getting ready for her morning classes. No rah-rah sophomore, she has spent 20 years as a nurse, and now she's studying public health nursing, a subject in which she's intensely interested.

As the morning light brightens her college room, she gayly hums a

Ellen Bradley

snatch of *Parsifal*, for which she confesses a passion. After a final glance in the mirror, she pats a stray lock of close-cropped blonde hair into place and starts out across the grounds of the University for her morning coffee. To anyone who asks, she says she "can't last out the day without at least six cups of good coffee." It's a habit she attributes to her six years in the Navy, serving as a nurse at hospitals in Brooklyn, Washington, Portsmouth, Corpus Christi, and Bethesda.

One who likes the company of others, Ellen Bradley has particularly enjoyed her course at Columbia because she's met so many students from other countries. And there's a restaurant near the campus where Mandarin Chinese food is served, an attraction she can't resist.

Two years ago she inherited ten shares of telephone stock from her grandmother, and it is still in her possession.

South across the bay, past the Statue of Liberty, past Sandy Hook and down the coast, people are up and about in Asbury Park, N. J. A booming voice rings through a trim white house on First Avenue where Albert Elker, a spectacled man of sixty with the build of a plunging fullback, gets ready for work. An installation foreman for the New Jersey Bell Telephone Company, Al Elker has been in telephone work since 1912, the last 34 years of that time in Monmouth County; and he chuckles as he says that he's "personally acquainted with every telephone from Red Bank to Lakehurst."

He and Mrs. Elker have raised four children in that white house, and he talks about them as enthusiastically as he does about his gardening

Albert Elker

and motoring. He and his family, who have driven through every state in the 48, once drove from Asbury to San Francisco in four days flat, setting what must be some kind of a record.

Al Elker is a methodical man, and has his future as neatly planned as the rows of tomatoes that he raises every summer in the garden patch on First Avenue. He's been buying A. T. & T. stock ever since it was first offered to Bell System employees in 1915, and now holds more than 50 shares. "I sort of like the idea of owning a little piece of the outfit I'm working for," he smilingly admits.

Billy Brady

A patriotic citizen, he put all he could into war bonds during World War II. These will begin to mature in 1952, at the time he expects to retire, and this income too will supplement a pension based on nearly 40 years' telephone service.

SOUTH another hundred miles, where Cape May, N. J., probes like a tentative toe into the water between Delaware Bay and the broad Atlantic, morning finds an 11-year-old boy getting ready for school. Blue-eyed and blond, Billy Brady jams some marbles into his pocket, pauses briefly to finger a model airplane on his dresser, then races down the stairs to breakfast.

The roomy Brady house on Kearny Avenue is slightly dangerous for people unused to walking on "aggies," but Billy's mother and his father, a salesman in Philadelphia, are alert for such hazards. And recently Billy's attention has turned more to model plane building. He proudly points out that he's already built a P-80—"a jet fighter," he helpfully explains to adults—and he's working on a DC-6 right now.

As you might expect of a Cape May youngster, Billy is perfectly at home in the water—"a water rat," his mother says—and he's an active member of Boy Scout Troop 193. But when school is out for the day he becomes a business man. For it's then that he pedals his bike around the nose of the Jersey peninsula delivering the evening papers, an occupation out of which he has saved enough money to buy his two shares of telephone stock.

It was Billy's grandmother, "Nona" he calls her, who first interested him in buying the stock. She has 85 shares of telephone stock, part of which her husband, who died during the war, left to her, and part of which she has bought since. Last summer she explained to the young businessman how he might use his savings—accumulated by throwing thousands of *Philadelphia Bulletins* porchward through the cool Cape May air.

Frederika Peace Jenkins

"Mom let me buy a keen model plane kit with part of the first dividend check," Billy proclaims. Now in sixth grade, the alert boy plans on going to college; but the present is more exciting, and Billy confides that he really needs another model plane kit. Perhaps—with an eye on Mom—another one could be acquired some day before very long?

As Billy eats his breakfast, morning slips over the dunes of Hatteras, 300 miles south, then over the marshlands and up the Piedmont to Raleigh, N. C.

There, in a modest white two-story duplex just off busy U. S. Highway No. 1, three sisters, all of them former teachers and all of them now retired, live happily together. As they greet you at the door their eyes twinkle, for theirs is a youthfulness of spirit that comes of long years spent in guiding the unpredictable energies of children.

The youngest of the three—"the baby," the others jokingly call her—is smiling, gentle Frederika Peace Jenkins. Happy with her sisters and her Raleigh friends, she nevertheless likes to watch the traffic roaring by to the north and the south on nearby U. S. 1 and think about seeing new places and new people.

"I really can't afford much traveling, but that is what I should like to do," she says. Then, with a quiet chuckle, she adds, "Anyway, I can read about it in magazines and travel folders."

The daughter of a Methodist minister, Miss Jenkins received her degree from Duke University. But

Suzanne Fassnacht and Rickey

her education, like that of most teachers, was a continuing one, sandwiched in between the years of teaching which ended when she retired two years ago. Over those decades, thousands of students learned history and English from her lips.

A member of the American Library Association, her love of fine books is deep, and she keeps many of her favorites around her, some of them in beautiful leather-bound editions.

As she went along, Miss Jenkins managed to save some money—not a great deal on a teacher's pay, but enough so that, more than 20 years ago, she could buy some A. T. & T. stock, and she still has her eight shares today. She thinks the telephone company is "the nicest company that can be; its employees are always courteous and prompt."

One could enjoy talking with Miss Jenkins for hours, but we must be off to make another visit—west this time 400 miles, across the Blue Ridge Mountains to Chattanooga, beside the Tennessee River where it spills past Chickamauga dam.

In a house on quiet, shaded Englewood Avenue, gay, sparkling-eyed Suzanne Fassnacht is busy in the kitchen getting breakfast for her husband John and for one-year-old Rickey, over whom she fusses and beams like any young mother. After caring for them and doing the housework, Suzanne doesn't have too much time these days for activities outside her home, but she manages a good deal of active work in St. Joseph's Circle, a women's organization in Sts. Peter and Paul's Church, Chattanooga's oldest and largest Catholic Church.

In her late twenties, she snatches spare moments at home to work rapidly with long, skilled fingers at her art. Once, before she met John, she considered a career as an artist, and took several courses of instruction. It's a hobby now, but she's expert with water colors, oils, and pencil, and enjoys modeling in clay now and then.

Four years ago her uncle, who has owned telephone stock for many years, bought five shares and made Suzanne a gift of them. Since then a baby boy and a new home have been added to their possessions—which still include Suzanne's five shares of A. T. & T. stock.

Just as morning arrived in Chattanooga, it was sweeping across the rolling farm lands of Ohio, far to the north. On a 70-acre farm three miles south of Lancaster, George Lamb, a stocky man in his late fifties, is out looking over his sheep, pulling down the brim of his gray hat against the morning sun and proudly inspecting a woolly new arrival. This is the farm where he was born, and which his father owned before him. He bought it before he retired two years ago as assistant superintendent of the Ohio State Boys' Industrial School in Lancaster, after 36 years of service.

Mrs. Lamb also worked for 25 years at the school, which now pays both of them a pension. Justice of the Peace for Hocking Township and central committeeman for the Democratic organization there, George Lamb is more interested in

George Lamb (right), his son-in-law, and a new arrival raising stock on his land than in growing crops. He has about 100 sheep and 20 head of cattle, and he has had success with chickens, ducks, and turkeys.

He became a grandfather last year, and he harks back to his own boyhood here when he shows you his extensive collection of Indian relics, most of which he gathered then.

Aline Glossi

Fifteen years ago George Lamb began to buy small amounts of telephone stock. In steady, regular purchases he continued to accumulate more. Today he has 350 shares, none of which were given to him or inherited.

Northwest 300 miles from George Lamb's farm, in a big white house on a hill, just a block off Main Street in Ionia, Mich., Aline Glossi sits down to breakfast with her family. You might say the Glossis are a telephone family, for of Aline's eight brothers and sisters, one is a former plant clerk and two are local operators. Aline herself is a service representative. A pretty girl with a quick smile and dancing eyes, she has lived in Ionia all her life except for four years in New England during the war. She likes it here in Ionia, for there's enough room, and time, to go around. It takes her only five minutes to walk to work in the morning, and she usually comes home for lunch.

Only once a year does the little city get turned upside down. That's when the Ionia County Free Fair opens in the summer, attracting farmers and townspeople for miles around. In the parade before its opening, dark-eyed Aline and other pretty girls ride down Main Street on merchant-sponsored floats.

With three years in the Michigan Bell Telephone Company, she knows personally many of the customers who drop by or call the telephone office. In her spare time, like thousands of other young American girls, she likes to read and knit, and enjoys dating, skating, bowling, and bridge.

For Aline, being a telephone stockholder is an interesting new venture. At her request, ten dollars a month was allotted from her pay for a little more than two years, and early this year she received two shares of stock.

Due west of Ionia across Lake Michigan, morning soon stirs South Milwaukee with a fresh lake breeze,

Linda Schmitz

and the city comes to life. In a comfortable brown bungalow set back in a neat yard on Marshall Street, Linda Schmitz, a graying, pleasant-faced woman, peers through rimless glasses at a bank of plants in the living-room window. Noting a bright new blossom, she smiles with satisfaction and goes on into the kitchen to help with breakfast.

Mrs. Schmitz, whose husband died in 1936, has lived here in this quiet residential neighborhood with her sister and brother-in-law ever since her only son, a bombardier-navigator in the Army Air Force, was killed on Christmas Day 1943. Before that, she lived in Madison, and she often returns there to visit with her friends.

She knows how welcome a sympathetic companion can be at times when illness or other troubles strike, and she makes it a point to visit and console friends who are sick or unhappy. With a quiet smile she says, "I go wherever there's someone whose morale needs boosting."

At home she has two consuming hobbies. One is caring for the house plants—African violets, begonias, and a prized spider plant—which she and her sister grow. The other is canasta, for which she has so much enthusiasm that there's a game in progress almost every day in the bungalow on Marshall Street.

Her husband, who owned a filling station in Madison, left Mrs. Schmitz some shares of telephone stock. Later she bought a few more, and she now owns 17.

WHILE Linda Schmitz prepares her breakfast, morning rushes west, over the Mississippi, over golden seas of wheat and tasseled corn, over the prairie, to Lawton, Okla. In the doorway of a one-room white frame cottage near an Indian Mission there, stands tiny, wrinkled Tah-wat-is-tah-ker-na-ker, a Comanche woman of unknown age. A scarlet blanket wrapped about her shoulders against the morning breeze which sweeps across the plain, she watches with piercing eyes as a long freight train rumbles into the distance on rails gleaming in the sun.

Tah-wat-is-tah-ker-na-ker, or Lucy as she is called by the white tradesmen with whom she deals in Lawton, is no more than five feet tall and weighs about 90 pounds. Dressed under her blanket in a printed percale dress, a belt of blue beads, fringed leggins, and moccasins of yellow deerskin, she wears a net over her iron gray hair.

She speaks, reads and writes no English, but her business advisor, who acts as her interpreter, says "she is a woman with a lot of character. She signs papers with either a cross-mark or a thumbprint, but her shrewdness is surprising."

Besides the white frame cottage, where she and her husband, Wuth-take-qua, live, Lucy owns a Ford sedan and 160 acres of land at Apache, Okla., allotted to her by the government under a treaty with the Comanche, Kiowa, and Apache tribes.

It was one afternoon more than 20 years ago when she walked into her advisor's office, unrolled a piece of cloth, and revealed a pile of crumpled bills. In Comanche language she asked, "How can I make this money work? What do white people do?"

He suggested the purchase of telephone stock, which she has held ever since. Of the telephone company, she says tersely, "They are good people."

Tah-wat-is-tah-ker-na-ker

On across these plains which Lucy's ancestors roamed in ages past, northwest 500 miles, in a modest apartment in Denver, August Larson, a mild mannered man in his early sixties, slight in stature, with a closely trimmed mustache and thin gray hair, soon is up and getting ready for work.

If August Larson dreamed last night, he might have dreamed of a farm boy in Sweden, tilling the soil with his eight brothers and sisters, and filling in, when work was slow, with trips to sea on a fishing boat. And there might have been a dream within a dream, for the farm boy dreamed of America, and the opportunity he had heard it offered. The boy saved his money, and finally came to America, where he went to George Washington University, in Washington, D. C., for a while and then went into business for himself as a patent draftsman.

Men brought him ideas for new machines, and he refined them, and

August Larson

put the details carefully down on paper. Then, 30 years ago, the young draftsman moved to Denver and continued his business there. The young man's name, of course, was August Larson.

Nine years ago, when war made rubber a critical commodity for the nation, he joined the Gates Rubber Co. as a machine designer. He remains with them today. He gets a quiet satisfaction out of having helped create the machines which have been a part of the growth of America.

A long time ago he bought what A. T. & T. stock he could then afford, and he and Mrs. Larson have bought more shares since. Perhaps akin to his pride in having helped create the machines which have played a part in the progress of America is the satisfaction he derives from the knowledge that his savings too have helped American business to grow.

As August Larson breakfasts, morning sweeps across the Rockies and down into the northern end of the Imperial Valley, a scant 40 miles from the Mexican border, where 38-year old Franklin Garrett has an

Franklin Garrett with a customer

electrical appliance shop in Calipatria, Calif. A tall, darkly handsome, quiet-mannered businessman, he is an ardent supporter of his community. He takes the seasonal heat in the valley philosophically, and even tells you quickly "It's normally four degrees warmer here in the north end. That lures new ranchers, for the additional heat provides a longer growing season for tomatoes, squash, peas, grapes, sweet corn."

Vitally interested in the youth of his town, he serves as a member of its Youth Recreation Association, and works tirelessly in promoting Community Chest and Cancer Society activities. Electricity is not only his business but his hobby as well, and he spends hours developing electrical gadgets in his modest home on West Alexandria Street and in the shop of his appliance store.

He has recently taken up photography, and his two-year-old daughter, Lynn Marie, finds herself being posed for pictures more and more often nowadays. Evenings he and Retha, his pretty wife, like to play cards with their friends.

President of the Calipatria Lions Club, Franklin Garrett is also active in the Boy Scouts. He is a member of the City Council, and moderator of the Calipatria Community Church, where Mrs. Garrett sings every Sunday in the choir.

He has owned stock of the A. T. and T. Company since 1933.

By now our journey and visits are nearly done. For, almost exactly three hours after morning first vaulted past the New England shore, it reaches the city of the Golden Gate, and stirs alive San Francisco's sprawling harbor.

Professor Arthur Williams

On the eastern shore of the harbor, in Wheeler Hall at Berkeley's famed University of California, Professor Arthur Williams prepares for his morning classes in mathematics. A modest man who looks forward to his approaching retirement, Professor Williams has been teaching at the University for more than 30 years. Thousands of students have become familiar over the years with his thoughtful, serious face and intent eyes peering at them through polished glasses during his lectures on higher mathematics.

Here in his office lined with books, sitting beside the desk piled high with papers, pamphlets, and more books, Professor Williams recalls his youth in Connecticut, and speaks of the intense interest in mathematics which led him into a career in that subject. He modestly claims no major contributions to the science, but if you press him, he will admit having written "a few minor papers." It has been a busy career, he says, and has left him no time for courtship and marriage. "A bachelor in the cause of science," Professor Williams calls himself. Soon now he will retire. He looks forward to this because he will have more time to devote to independent research and study.

It was in 1933 that Professor Williams first bought some shares of A. T. & T., and since then he has periodically bought more. Today he has 245 shares.

THIS VISIT with Professor Williams finishes our flying trip across the land. We have met briefly a few owners of the Bell System:—a gardener and his wife, a nurse, a telephone man, a newspaper boy, a retired teacher, a housewife, a farmer, a telephone girl, a widow, an Indian woman, a machine designer, an electrical appliance dealer, and a professor.

These people hold from two shares to 350 shares of stock. They live in cities, towns, and rural areas, from the Atlantic to the Pacific. Three things they have in common. One is their ownership of A. T. & T. stock. This, and the fact that they are Americans, makes each of them an American capitalist; and American capitalists, as a class, are the envy of people in other nations throughout the world. Lastly, there is the hospitality which they showed when they allowed us to visit them and talk with them. Without that great courtesy, this article could not have been written.

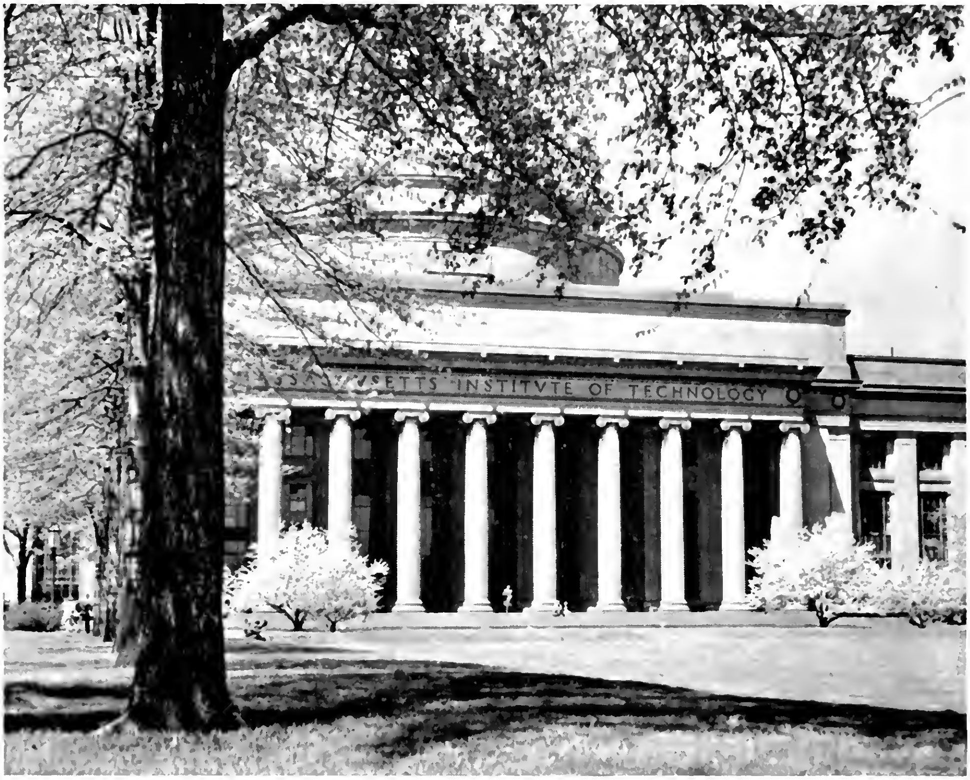
In other respects they differ. This is natural, for every American is an individual, with his own habits and tastes and way of living. Where human nature is concerned, there are no averages. And there is no "typical owner" of the Bell System.

There are, however, three simple facts which help to describe A. T. & T. stockholders *as a group*. There are about twice as many women as men among them. About one in five is an employee of the Bell System. And their average holding of stock is about 28 shares.

The owners of the Bell System range up and down the whole scale of life in these United States. To fill out the picture, let's look for a moment at a couple of the largest. High on the list is a brokerage house which reports that on a recent day it held 91,719 shares. Asked about this large holding, a partner of the firm pointed out that the shares are actually held in account for 2,736 of the firm's customers—the people who actually own the stock. These people thus own on the average about 33 shares, and they are scattered from the Atlantic to the Pacific.

A bank, an even larger holder than the brokerage house, says that its shares, too, are held in many different accounts. Here the average is larger—about 90 shares per account. And who are the owners of these accounts? Again, most of them are individuals, but the largest is an institution, which in turn represents many people.

It is natural that the very largest stockholders should almost all be



Massachusetts Institute of Technology is among the hundreds of hospitals, colleges, schools, churches, and other institutions which are stockholders of the American Telephone and Telegraph Company

corporate holders—insurance companies, banks, and others—for these represent the collective savings of thousands of individual investors. Among the institutions which are stockholders, one finds hundreds of hospitals, colleges, schools, and churches.

Look at it any way you like, it all comes down to people. Not people in any one class or in any one section, for it has needed more money to build the Bell System than the people in any one class or section could provide.

It has needed the investments of people in every walk of life the country over to add up to the billions of dollars which have built the biggest single enterprise in America; which have provided half a million telephone jobs; and which have—together with the investment in nearly 6000 independent connecting telephone companies—brought to the people of this nation the most and the best telephone service in the world.

The Treasurer of the A. T. and T. Company Discusses Factors Involved in Carrying Out the Traditional Concept of The Bell System's Obligation to Three Groups

The Telephone in the American Scene

Donald R. Belcher

The following is based on an address given before the convention of the Virginia Bankers Association on June 14, 1950. EDITOR.

THE DEVELOPMENT of telephone communication here in Virginia has been typical of its growth in the nation as a whole. Except for a few years in the late 1930s, the American people have always had more telephones at their service than all the rest of the world combined. Use of the telephone has become so much of a habit with us that the whole tempo of our business and social life is dependent upon it. In fact, our ability to talk clearly and quickly to almost anyone anywhere in the nation is distinctly an American phenomenon, like our use of the automobile, the radio, and, more recently, television.

There are now over 41 million telephones in the United States—twice as many as we had ten years ago. The telephone network of which these instruments are a part has cost about eleven billion dollars to build, it directly employs about 600,000 people, and it is owned by more than a million stockholders. Eighty-two percent of these telephones are owned and operated by the Bell System, about which I am primarily speaking today. The remainder are served by some 5,600 other telephone companies and 60,000 farmer lines outside of the System but connecting with it. Co-operation between these connecting companies and ourselves is most harmonious.

Competition vs. Regulation

THE AMERICAN PEOPLE have traditionally relied upon direct competition to assure that they have the best possible products at the lowest possible prices. In our industry, however, after some years of experimentation, it became abundantly clear that competition between two or more telephone companies in any local area would be ruinous to telephone service. Competition of that sort has long since been eliminated. In fact, it is now well understood that interconnecting plants and unified operating practices throughout the country are essential to good nationwide telephone service.

In lieu of direct competition to protect the public interest, governmental regulation has long been the recognized alternative. Today we are regulated by the Federal Communications Commission and by commissions in practically all of the states. I hardly need tell you that regulation is accepted and welcomed by telephone companies as the logical arrangement for the operation of private industry in this essential field. History demonstrates that this arrangement can be a satisfactory one for all concerned as long as constitutional principles and justice are fairly upheld.

But while I speak of the absence of direct competition, let me point out that the telephone industry, like every other, must always compete for the customer's dollar, which he may elect to spend for other services or wants. Furthermore, there is within the business itself an abundance of competition which makes for efficiency. In spite of its size, the Bell System is essentially a local enterprise in the communities which it serves. It is managed by home-town people, it employs home-town workers, and its owners are home-town folks. Its revenues, which are disbursed in the form of payrolls, suppliers' payments, interest, and dividends, are spent in home towns.

The president of each regional operating company has come up step by step from the ranks and, as you know, the companies' boards of directors are composed mainly of local people from outside the telephone business who are in close touch with their community affairs. The efficiency of every local exchange, of every district, and of every area is under constant measurement against others in the System; and, since promotions are up from the ranks, there is a healthy competition at all levels which results in the advancement of men who offer the most promise.

Fundamental Policy

As bankers, you are accustomed to taking the long view of affairs related to your business. The Bell System, for its part, has always taken the long view of telephone operations, recognizing that this is the only policy that will succeed over the years. Being responsible for so much of the nation's telephone service, it has accepted its obligation as a public trust. Many years ago the fundamental objective of the System was expressed in these simple words: "Our purpose is to provide the most telephone service and the best, at the lowest cost consistent with a fair return to investors and fair treatment of employees."

This, I might say, is the golden rule of the Bell System. It is the rule against which all our smaller objectives and short-run plans are measured. It encompasses our basic obligations to the three groups with which we are chiefly concerned: the telephone-using public, our employees, and the investors in our securities. As long as this is true and the public understands it, we should have little to fear from the followers of alien idealogies.

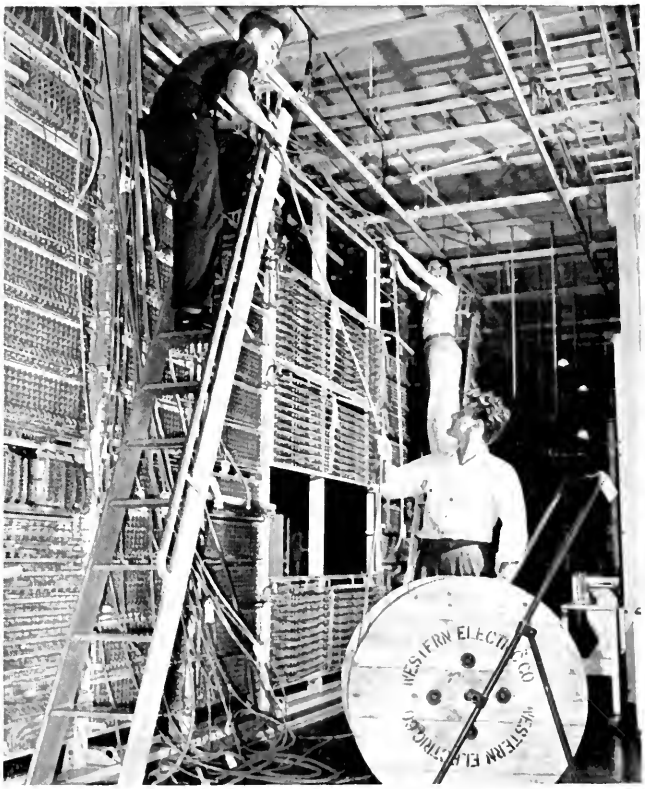
The Obligation to Customers

For the telephone-using public, our purpose, as I have just stated, is to provide the most and the best possible telephone service at the lowest cost consistent with financial safety. Today, with six percent of the world's population, we have 60 percent of the telephones. Our total of 41 million telephones in and connected with the Bell System is equivalent to one telephone for every four people in the nation.

Since the end of the war, we have added 12 million telephones. To install these telephones, and provide the wires, cables, switchboards, and central office buildings required to interconnect them, we have spent about five billion dollars. This has made it necessary to obtain over three and a half billion dollars of new capital from the investment market, representing the greatest financial effort of its kind in the history of American corporate enterprise.

Operator dialing of toll calls has been extended to about one third of our intercity business

Recognizing that the installation of 12 million telephones was not enough in itself, we have been pushing vigorously toward the goal of furnishing the best possible service. Bell System service has improved greatly since the war, and is now better in quality and speed than ever before. Nevertheless, new items of telephone equipment are being installed, or are under test, or are on the drawing board, which promise even greater convenience and dependability for the telephone user. About three-quarters of our telephones are now dial; a new handset telephone now under test has even better hearing and speaking qualities than those now in use; the operator dialing of toll calls has been extended to about one-third of our inter-city business.



Costs are higher where more people have to be inter-connected and more elaborate switching equipment has to be installed

Some of our new assemblies of central office equipment are marvels of electrical ingenuity, using the latest developments in the electronic field. For example, in one type of central switching office, when a dialed call is delayed in getting through because of some mechanical trouble, the equipment locates the difficulty, punches holes in a special card to tell the story, rings a bell, and drops the card in a box for a repairman. Another central office set-up gradually being put into use automatically records on punched tapes, sorts, and assembles the data necessary for billing calls dialed by the subscribers.

The advances in telephone service—those which have been accomplished and those now in the making—are directly attributable to the close integration within our System of the Bell Telephone Laboratories, which carry on telephone research, and of the Western Electric Company, which manufactures telephone apparatus, purchases supplies, and installs central-office equipment. Good telephone service at low cost is not something which just happens. On the contrary, to make the service continuously cheaper as well as better requires the closest kind of coördination between research, manufacturing, and operation. We are convinced through long experience that this arrangement is in the best interests of the telephone user. Only in this way can he reap the fullest benefits from scientific research and mass production.

When the first transcontinental

call was made between New York and San Francisco, as recently as 1915, the cost of such a call was $20.70. Ten years later it was $16.50. Today the same call costs only $2.50. This is but one dramatic instance of lower costs out of hundreds that might be mentioned. Others, such as local service, for example, would not be so obvious unless cost comparisons were made in dollars of equal purchasing power.

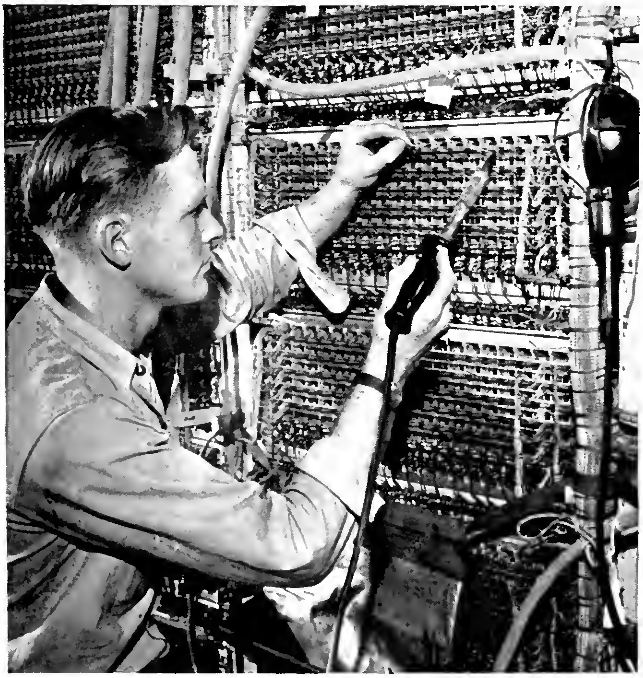
There is the further fact, which is frequently overlooked, that providing telephone service in local exchange areas is not a mass production job in which costs decline with the greater numbers served. Quite the reverse is true. Costs are actually higher in the larger centers of population where more people have to be interconnected and more elaborate switching equipment has to be installed. In other words, unit costs tend to increase with growth in number of units.

The Obligation to Employees

Upon employees devolves the first-line responsibility of giving courteous and efficient service, and to do this job they should be among the best available in the range of their required skills. To obtain and hold such employees, the telephone business must pay wages that compare favorably with those paid to others in the community for similar work.

In addition to steady, year-round employment at good pay, and opportunity to advance on merit, telephone people have a benefit plan covering sickness and retirement which is one of the oldest and most comprehensive in industry. We know, however, that in addition to providing employees with this kind of fair treatment, it is equally important to insure that every employee understands not only what fair treatment consists of but also that fair treatment implies a definite responsibility on his part to the service.

The Bell System companies have undertaken to get such understanding throughout all levels of personnel. We also desire our people to have an understanding of the simple



Employees should be among the best available in the range of their required skills

Telephone people have a benefit plan covering sickness and retirement which is one of the oldest and most comprehensive in industry

facts about the economic system of which they are a part and the relationship of these to the telephone business. In other words, we wish them to appreciate that their interest and that of the business are one and the same.

The Obligation to Investors

Unless we provide over the long run a fair return to investors, we can neither maintain the credit standing necessary for expansion and improvement of facilities to meet public requirements nor can we pay good wages to employees.

In the field of finance, our doctrine is that the people who have created this great public enterprise through the investment of their savings are entitled to receive a reasonable return and to have their savings safeguarded over the years. It is good ethics to treat investors fairly. It is also good business judgment, and basic to sound financing. Unless investors are well treated, it is unlikely that old friends or new friends will invest their savings when the business needs more capital.

The financing of the Bell System has always been conducted on an integrated basis. Under this arrangement, the American Telephone and Telegraph Company has traditionally played a major role in securing the System's capital from the national securities markets. As a result, its securities represent about 75 percent of the Bell System total capital. Still more significant is the fact that the common stock of the A. T. & T. represents over 97 percent of the equity capital underlying the entire System.

At the present time, the A. T. & T., as parent company of the System, is owned by 970,000 stockholders. This represents about one stockholder in every 50 families in the United States. They are all kinds of people, of all levels of income, since the capital to finance a business as large as ours must come from a true democracy of ownership. Approximately 200,000 are Bell System employees, most of whom have bought their shares through payroll savings under our Employees' Stock Plan. The average number of shares held by all stockholders is 28. Our largest stockholder is a bank nominee holding stock for about 1,400 of the bank's customers. In fact, 22 of our 30 largest stockholders, none of whom are individuals, are bank nominees. Even though the shareholdings of each of these thirty have an equity value in the millions, none holds as much as half of one percent of the total stock, and no individual owns as much as one twenty-fifth of one percent.

A Stockholder Institution

The foundation of our entire financing program rests upon equity ownership, with a long-range average objective of not more than one-third debt in our capital structure. We entered the post-war era with a debt ratio of about 30 percent, but the necessity of raising three and a half billion dollars in new capital—at a time when neither our earnings position nor the equity market was favorable—has resulted in our now having a debt ratio of about 50 percent. As investment specialists, you can appreciate that the Bell System would have been placed in serious jeopardy if it had entered the post-war era with a debt ratio as high as 50 percent. I am quite certain that we could not have met the demands of the public as we have.

During these years of heavy financing, however, we laid the basis for an improvement in our debt position by selling more than one billion dollars of A. T. & T. debentures convertible into stock. You are familiar with these convertible debenture issues which were offered to stockholders through subscription rights. The three offers since the war could not have been wholly successful without the interest and the assistance of the banks throughout the country. In view of the great number of stockholders involved and the 200,000 or more subscriptions received under each offer, I imagine that almost every member of the banking fraternity had some part in these particular financial undertakings.

Let me say here that we have no intention of being a debt institution.

We are going to continue to be a stockholder institution, and our firm purpose is to see our debt ratio steadily reduced. Half of our convertible debentures issued since V-J day have now been converted into stock. Conversion of the other half, together with the sale of the remaining shares authorized under our Employees' Stock Plan, will mean the issuance of some seven million additional shares. That would reduce the debt ratio to about 40 percent. As further capital is required, it is clear that the greater part of it should come from the issue of stock, either through bond conversions or otherwise.

Repricing Program

The attraction of needed equity capital can only be achieved by securing adequate earnings. This brings me to the second of the two closely related problems which confronted us when World War II closed. The first of these problems, as I have said, was to meet the tremendous demand for telephones and to get the quality of service back to pre-war levels. The second problem, forced upon us by sharply rising costs of rendering service, has been to bring about a proper repricing of telephone service. Substantial progress has been made along these lines, with some rate increases obtained in every state. Numerous applications for additional increases are pending, and other applications will be made. All told, increases of about four hundred million dollars on an annual basis have so far become effective. This, however, is equivalent to little more than half the annual cost of wage increases which our employees have received during the war and post-war period.

In addition, of course, we have had other cost increases to take into account. Probably most important of these is the greatly increased cost of plant for growth and for replacement. This has meant that our aver-

Subscribers to A. T. & T. convertible debentures received individual attention in the lobby of the headquarters building in New York

This display dramatizes to employees and the public the fact that A. T. & T.'s 970,000 stockholders represent about one stockholder in every 50 American families

age cost per telephone has been constantly increasing, with the result that at any given level of telephone rates our rate of return has trended downward.

Through the 1920s, in the expansion period following the first World War, the System's earnings on invested capital were on the order of 7 percent to 8 percent or more and averaged 8 percent for that decade. During the present expansion period, they have been far too low. They have recently been improving, but they are by no means up to requirements, particularly for times like the present when the general level of business activity is extremely high.

The question of what rate of return would be adequate for our needs and at the same time fair to our customers is one to which we in the Bell System have devoted a great deal of study and thought. In the light of our own financial experience and the pertinent experience of other industries, we are convinced that in years of peak business activity like the present, a return of 7½ percent or more on total invested capital is necessary and no more than reasonable to bring about a desirable capital structure and insure the health of our business.

In the last analysis, of course, it is the verdict of the market-place which determines the level of earnings required. To provide further amounts of equity money as needed, investors all over the country must be persuaded to buy many millions more shares of A. T. & T. stock. To attract common stock investment, earnings must be sufficient, as new shares are issued, to insure a stable return on this new capital as well as on the equity already employed in the business. Obviously, for this purpose, the established rate of dividend must be earned with enough margin in good times to retain the confidence of investors for the long pull. It will interest you to know that, as contrasted to a rise of some 70 percent in living costs since 1939, the repricing of telephone rates already authorized, plus amounts now pending, averages only some 20 percent of Bell System revenues. Our companies have not asked and do not intend to ask for more than is required to meet their responsibilities properly and well.

Judged by results, the political and economic climate in America has been favorable to enterprises like the Bell System. It has been stimulating to research, to invention, and to investment; and it has given management a large measure of freedom for the achievement of its purpose. The high quality of telephone service Americans enjoy today is one proof.

We are confident that the surest way to preserve the telephone business as a private enterprise is to keep serving the public in such a way that they will want to continue to entrust this vital service to our charge. Only in a country like the United States, where individual incentive and team play are given the fullest opportunity, could the use of the telephone have reached its present stage of development. Only where there is a widespread willingness of people to venture their savings in ownership can the high standards of living—to which the American people have become accustomed—be achieved.

Submarine Cables with Unique Self-Containea Repeaters, Recently Laid between the United States and Cuba, More Than Double the Facilities Linking the Two Countries

New Voiceways under the Gulf Stream

Leslie R. Johnson

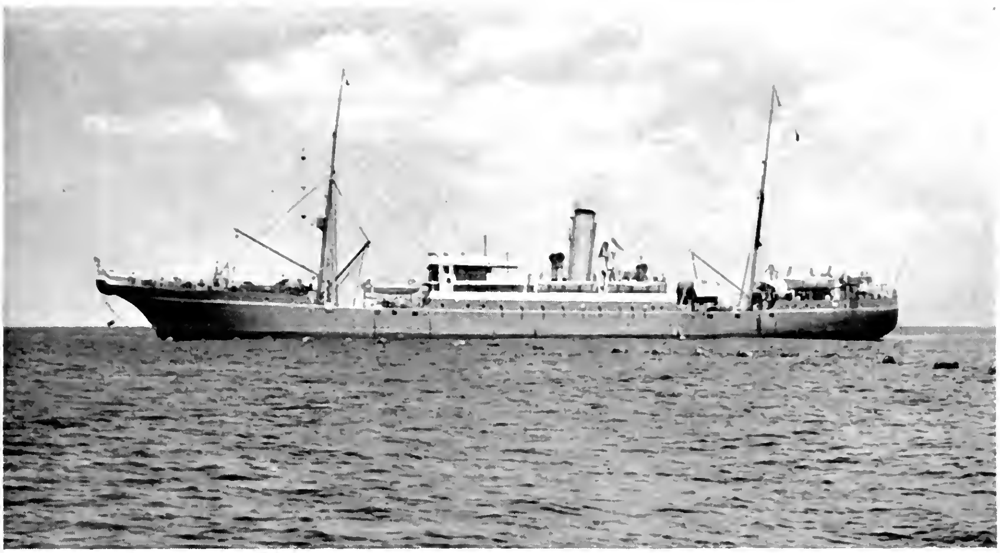
THE TENSE GROUP on the forward deck of the cable ship *Lord Kelvin* watched intently the splicing operation going on under the deck lights in the tropic night. Except for an occasional word, and the soft slap of water against the hull, the silence was unbroken.

Then, at last, the job was done. The telephone technicians and the ship's personnel stepped back, and the long dark snake of cable was eased over the deck. A slight splash in the darkness—and the newest submarine link between Key West and Havana, culmination of a quarter of a century of development, was ready for trial.

A few minutes later, power flowed through the cable: from the Long Lines office in Key West, over conductors in the steel- and jute-covered cable, through its remarkable repeaters, along the section so recently joined (now at the bottom of the Florida Straits), and on to Cuba.

All went well. That critical moment aboard ship, some five miles seaward from the tiny island of Sand Key, just about 10:00 P.M. on Sunday, April 30, had now become an historic occasion. The seven telephone men immediately joined the ship's captain and his staff, to toast the years of laboratory development, the careful preparations, the skillful shipboard operation, and particularly the unique self-contained repeaters of the new submarine cable. Above all, they hailed the various groups —and especially the Bell Laboratories men—so long engaged in bringing the first long deep-sea repeatered submarine cable project to successful accomplishment.

This splicing episode was the final chapter in a story of continued growth in telephone communication between the United States and Cuba: a tale involving research leading to vacuum tubes with a longer life than had ever been dreamed of before as



From the chartered Western Union cable ship "Lord Kelvin," close off shore at Havana, the landward end of one cable is being floated ashore by means of empty oil drums

well as the development of telephone repeaters capable of carrying two dozen telephone conversations simultaneously and of operating at the bottom of the ocean for years. But let's go back to the beginning, and unfold the story of telephone communication with the island.

The Earlier Cables

FOLLOWING World War I, the need for telephone connection between the United States and Cuba became apparent, and in 1921 the first link was established by completion of three single wire submarine cables between Key West and Havana. This undertaking was handled by the Cuban-American Telephone and Telegraph Company as a joint venture of the American Telephone and Telegraph Company and the International Telephone and Telegraph Corporation. These voiceways under the Gulf Stream made possible the first direct connection between the telephones of the Bell System and its connecting companies and those of the Cuban Telephone Company in Cuba.

At the time, these were the longest and most deeply submerged cables in use for telephonic communication. The cables (each of 100 to 105 nautical miles) were of English manufacture, in most respects similar in construction to telegraph cables of the period. Each contained a single central conductor insulated with gutta percha and another outer copper conductor which, together with the ground and sea, formed the return circuit path. An unusual feature of the cables was a wrapping of iron wire over the central conductor. This was to provide "loading" to increase their efficiency—that is, the inductance of the circuit was increased by the use of iron.

By present-day standards, these

An engineer connects parts of a submarine repeater during experimental work at the Bell Telephone Laboratories

the first three links. It was also necessary to select a route to avoid telegraph cables of other companies which likewise cross the Gulf Stream in this region.

In another decade still more speechways were required. This time, however, it was not necessary to place another cable. Because of its forward-looking design, the No. 4 cable had a wider band of frequencies which could be utilized for additional telephone channels. In January, 1942, a special carrier system, somewhat similar to carrier systems then being employed in the Bell System to provide greater numbers of channels,* was installed. This arrangement increased the capacity of the No. 4 cable from the original three telephone channels to a total of seven.

Immediately after World War II, the demand for additional circuits to Cuba became so great that, pending the time when a more permanent solution could be obtained, temporary and emergency carrier systems were placed upon the seven channels of the No. 4 cable. A total of 14 circuits was provided by this link, but only at some sacrifice in the quality of transmission. By using all four cables, a total of 17 telephone circuits (in addition to the telegraph circuits in the initial three cables) was made available for operation early in 1950.

cables would transmit only a comparatively narrow frequency band. However, with appropriate equipment at both ends, each of the three cables provided one two-way telephone channel and several telegraph channels.

By the end of the 1920s, these three telephone circuits had become inadequate to handle the increased traffic, so in 1930 cable No. 4 was installed. This cable, which included new techniques of design, insulation, and equipment developed by the Bell Telephone Laboratories, was of German manufacture. Capable of carrying a much wider band of frequencies than the earlier cables, this new nonloaded cable initially provided three telephone circuits by means of a three-channel carrier system similar to those then used on open wire lines. In order that it might be laid in a location separate from the earlier cables, it was made some four nautical miles longer than the longest of

* See "Carrier Is King," MAGAZINE, Winter 1949–50.

The New Cable System

Four types of protective armor were used on the cables, from the double layer of steel wires (left) for rocky shore ends to the single layer of small wires (right) for deep sea sections

SHORTLY AFTER the No. 4 cable was placed between Key West and Havana, development work was started in the Bell Laboratories on a revolutionary type of deep-sea submarine cable system to provide an even greater number of telephone channels. Much of this paralleled work on land line carrier systems designed to furnish more and more channels with fewer conductors. This adaptation of carrier principles to long deep-sea cables introduced many new problems which had to be overcome. In customary Bell System fashion, each separate problem was tackled in its turn and a solution worked out—as you will see.

As finally designed and installed, the latest project consists of two submarine cables (Nos. 5 and 6)—one for southbound and one for northbound direction of transmission. It includes carrier terminal equipment for 24 complete telephone channels, or nearly two and one-half times as many as normally provided by the other four cables.

The transmission of wider frequency bands over long distances to provide many channels requires certain indispensable adjuncts: intermediate amplifiers or repeaters. The three repeaters installed on each of the new submarine cables make the Key West-Havana project unique as well as outstanding. Spaced about 40 miles apart, they are spliced into the cables, and appear only as bulges—slight enlargements in the cable—some 25 feet long.

The repeaters are marvels of technical design and perfect craftsmanship. The vacuum tubes inside these repeaters, as well as all components of these complex electric circuits, have been designed for extremely long life, because repairs cannot be readily effected. They are sealed within a tube container to withstand the pressure of water which, in the Florida Straits, reaches a depth of more than 6,000 feet. For mechanical strength, steel armor wires are placed over the outside of the repeater, just as they are placed around the cable core. The circuits are so designed that the operation of the repeaters can be checked electrically from Key West through built-in devices.

In addition to all this, the whole

assembled repeater is so flexible that —within limits—it can be bent over pulleys as is the remainder of the cable when it is lowered into or raised from the water. Finally, an example of the care which so important an undertaking requires is the fact that the repeater assembly was made in special air-conditioned and dust-free quarters.

Electric power for operation of the repeaters is supplied from the Key West office and transmitted to them over the same cable conductors that carry the voice circuits. The power supply equipment is in itself quite complicated, because it must be stable, reliable, and so designed that excessive currents cannot be accidentally sent through the cable. Obviously, burned-out vacuum tubes in these repeaters would be hard to replace. In fact, if failure of a part should occur, replacement of the entire repeater would be required. Such an operation would demand the services of a cable repair ship to grapple for the cable, to cut it and lift it up, and to splice in a section with a new repeater.

Each of the new cables, like the earlier ones, contains one coaxial unit. However, the central conductor is insulated from the outer conductor by solid polyethylene, rather than by discs of that material as is usual in coaxials in land cable. These cables, which are American made, also differ from the earlier ones by having the coaxial unit carried right to the terminal offices in lead-sheathed land cable similar in core construction to the submarine cable, rather than being connected to a different type of conductor in huts at the water's edge. In this way they extend one mile inland from the shore at Key West and about three miles at Havana. With the use of new insulating material and the need to make more secure joints, it was necessary to develop new splicing tools and methods for joining sections of this cable.

Try-out of the New Cable System

It takes close to two years to manufacture and install such a submarine cable system, and a substantial amount of money is involved. In order to minimize the attendant risks in such a complicated new system, and to insure its success in all phases, many tests and trials—both electrical and mechanical—of the component parts and assemblies were made. Samples of the vacuum tubes, for example, have been under test and are still operating after ten years. For effective tests of this nature, there is nothing better than time itself.

For testing, sample lengths of the cable were first made and placed in sea water. Then, some two years ago, complete repeaters were spliced into lengths of cable which were placed by cable ship in water of various depths off the Bahamas. Later, these were recovered for checking. All these trials indicated the feasibility of the final system and materially helped to guarantee its success.

Before any of the cable could be ordered, and before the repeaters could be assembled and adjusted for the length of cable they would be associated with, it was necessary to select a route, estimate the lengths and pick landing sites. Because of the relatively large number of cables already in the Florida Straits which

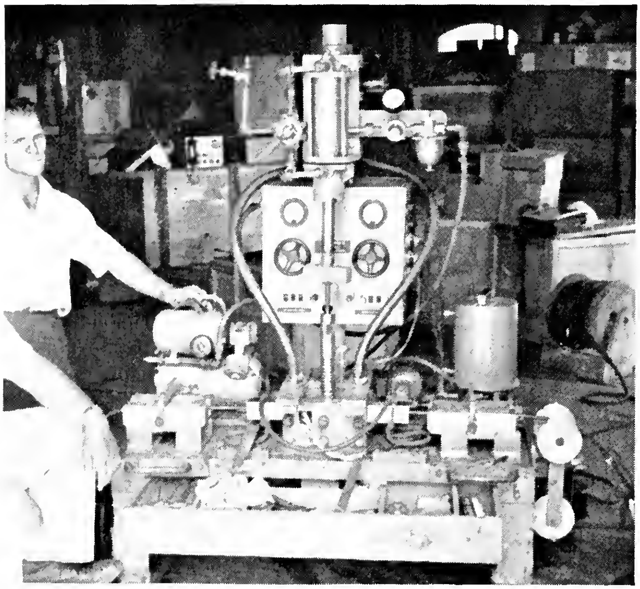
About eight miles of submarine cable are coiled on this barge, and are being made ready for placing in shallow water at the Key West end

had to be avoided, somewhat circuitous routes (of about 115 and 125 nautical miles) were selected, with about five miles of separation between the two new cables except where they converged at the landing points. The present Key West cable landing was quite satisfactory, but a new landing at Havana was selected because of troubles with the earlier cables from such things as corrosion, ships' anchors, and strong sea currents.

Laying the Cable

The land sections of the new cables were placed and spliced ahead of the work on the sea sections. The job at Key West was done by Long Lines Department forces and that at Havana by the Cuban Telephone Company. The land cables were made in relatively short lengths—a few hundred feet each—and were placed in underground conduit from the telephone offices to the water's edge. Since they were somewhat different from the usual land cable, it was necessary to train cable splicers for this work at a special school. The terminal equipment in both the Key West and Havana offices was also installed and tested before the deep-sea cable work, so that the operation of the over-all system could be checked immediately upon completion of the final submarine cable splice.

From Key West, the sea bottom



This molding machine uses controlled heat and pressure in forming polyethylene around the central conductor and making the insulation uniform at cable splices

slopes down very gradually, reaching a depth of about 100 feet in eight or nine nautical miles. At the Havana side, on the other hand, it is rocky and relatively precipitous. The sections of cable to be placed in the shallower water out from Key West to near Sand Key were shipped by rail to Miami, and there transferred to two barges which were towed to Key West. Last March, these sections of cable were placed in the relatively shallow water south of Key West by members of the Long Lines Department, who paid out the cable from barges towed by tugs. Near Sand Key, the ends of these cable sections were anchored to buoys, to be picked up later by the cable ship.

The pelicans of Key West were greatly disappointed during this work. They usually follow returning fishing boats, hoping to have fish tossed to them in accordance with local custom. But these boats, engaged as they were in surveying and cable-placing, never did produce fish. Like all true fishermen, however, the pelicans were always hopeful.

To lay the deep-sea portion of the cables, the Western Union Telegraph Company's cable ship *Lord Kelvin* was chartered. Not many ships in the world are equipped for such work, and it was fortunate that the *Kelvin*, with its well trained crew, could be obtained. It already had much of the special equipment suitable for handling this cable, but a considerable amount had to be added, particularly for testing and splicing, and its personnel had to be trained in the new splicing techniques.

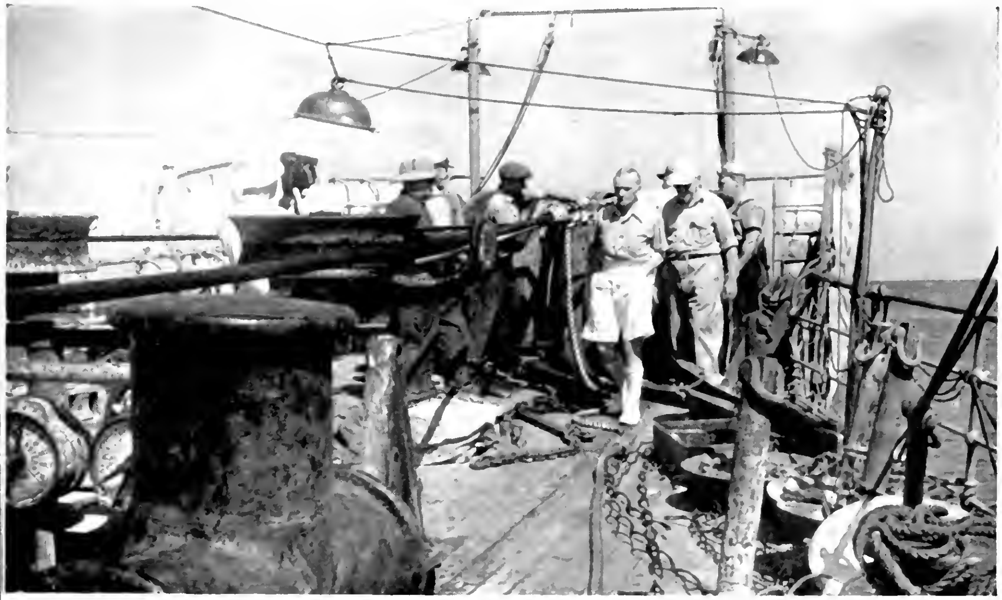
The cable was loaded into the *Kelvin's* cable tanks in such lengths that each cable could be laid in two sections—the longer length northward from Havana to the point of final splice, and a shorter length which reached southward from the buoyed end of the shallow-water cable near Sand Key to the final splicing point. By this arrangement, the cable could be laid through the deepest part of the Straits without stopping to make splices, and yet the final splice would not be too close to the shore. Another detail in loading the cables aboard the ship was to make allowance for suitable lengths of spare cable of different armor types, for repair of the working cables in the event of damage.

Two of the three repeaters for each cable were spliced into the cable in proper location as it was loaded into the ship. The remaining repeaters are located in one cable at the Havana shore and in the other cable at the shallow-water end near Sand Key. They were spliced in as the cables were joined at those points.

Charting the Course

AFTER ARRIVAL in the Straits, the first operation by the ship was to survey and mark the course of the cables with lighted buoys, spaced from 12 to 15 miles apart, to act as guides during the actual cable laying. This operation was especially difficult because of the circuitous routes, the tricky and variable currents of the Gulf Stream, sometimes reaching four or five knots, and the great depth in many locations. Each buoy's position was determined, the buoy was placed, and its position was rechecked shortly thereafter while the ship was in the immediate vicinity. Later the buoy was again visited and checked at least once before being finally used as a location marker. The ship's automatic depth-measuring equipment was also checked at each buoy location by a measured sounding wire. Some of the buoys carried oddly-shaped metal targets, to be located by the ship's radar equipment when the buoys were out of direct sight.

The preliminaries were now complete, all gear was checked, and it was time to lay the deep-sea cable



A section of one of the cables into which a repeater has been spliced goes over the bow of the Lord Kelvin, with the rope taking part of the strain. The captain of the ship, in light shorts, watches the operation with its integral repeaters. Since the ship could maneuver close into Havana, that end of each cable was pulled from the ship by a winch on shore, the cable being floated into position with the aid of empty oil drums. When the Havana end was secured at the landing and the floats were removed, the cable ship could then start northward paying out the long section at a maximum speed of about five knots. When the repeaters were reached, this speed was reduced and careful watch was kept as they, like the rest of the cable, went out around the braking drums and over the large bow sheave of the *Kelvin*.

In laying submarine cable, it is important to pay out the cable carefully under tension so there will be just enough slack to permit it to lie on the sea bottom without being suspended between the peaks and valleys of the ocean floor. For this purpose, special and very sensitive tension measuring equipment was designed by the Bell Telephone Laboratories.

Members of the ship's cable crew wrap armor wire over a newly completed splice

The ship was actually on the job about two weeks for the complete job of surveying, cable laying, splicing, recovery of marking buoys, and the discharge of spare cable for storage in tanks of sea water at Key West. Many of these operations were carried on both day and night. The laying of the long sections from Havana to the final splice points, for example, each required about 24 hours of continuous work from dawn to dawn. Five splices, each taking from 4 to 6 hours, were made on the ship.

It is a tribute to the accuracy of the engineering, navigation, and placement work that the final length of each submarine cable varied less than one-fifth of a mile from the length estimated and ordered nearly two years ago.

Tests at Every Step

During the cable-placing operations, both the Key West and Havana telephone offices were manned by several engineers, in addition to the regular personnel. Telephone connections were also maintained with the ship by radio and, whenever practicable, through the cable sections. Before, during, and after each cable-laying step, electrical tests were made by the testing staffs of both the ship and the Bell Telephone Laboratories.

Some 14 miles of spare sections of the cables are being unloaded from the ship at Key West into the concrete tank at the right, for preservation in sea water

There is something terribly final in placing anything at the bottom of the ocean, and it is good to know that all is well while corrections can still be made without great effort.

It would be untrue to say that all operations proceeded without difficulty. Fortunately, only relatively minor mishaps occurred—none which would affect the over-all success of the project. During the stress of long hours, such difficulties as a drifted buoy, a loose connection, or a failure of radio communication because of static loom rather large, until found and cleared. In all of the cable-laying operations, the safety of the personnel was guarded and no accidents to workers occurred.

Our new deep-sea repeatered cables were placed in regular commercial service at the end of June. Thus, almost thirty years after the first voice communication link was established between the United States and Cuba, the pioneer telephone circuits have been increased from the original three to thirty-four.

Each time telephone cables have been installed between this country and Cuba, the event has marked an important advance in the communications art. So it is with this remarkable pair of new facilities, which provide twelve times as many telephone circuits as did the first two cables to cross under the blue waters of the Florida Straits.

That's America to Me

Telephone Story of the "Telephone Hour" radio program of July 3, 1950

We used to go to Tabor's Grove on the Fourth of July—and maybe you went some place like that, too. A pleasant, wooded spot with a clearing in the middle. The soft summer sunshine dappled with shadow on the grass. The dusty lane leading into the clearing. Oh, it brings back quite a picture.

There was a wooden platform draped with bunting. And picnic tables. Everybody for miles around would come.

Days ahead of the big event, Mother would go to the telephone on the wall and ring up her neighbors to talk about what they'd take to eat for the picnic. And it was always the same—fried chicken and cold ham in great platters. Mountains of potato salad. Crocks of sweet pickles, fresh from the spring house. Devilled eggs. Cakes with frosting an inch thick, and homemade ice cream.

The town band was there, resplendent in blue and gold. And the main speaker of the day—a big man with a big voice, and it seemed to me that his speech was always longer than it needed to be.

That's America to me, and that's the picture I remember vividly on this most significant of American holidays.

The telephone was pretty well established then. A lot of the people in our town had one. Some even had the new kind that stood upright on a table, instead of being fastened to the wall.

Come to think of it, there's nothing that fits more appropriately into the observance of American independence than the telephone. It is a sort of symbol of this country—of the free speech and free enterprise we enjoy. It has grown as our nation has grown, and has helped in many ways to promote the welfare of our people.

Today there are more than forty million telephones in America. Each of them is dedicated to your service, for you have only to go and lift your receiver to be connected in a matter of seconds with any one of the forty million.

Ever improving, ever growing, ever giving in value far more than its cost, the telephone serves to unite the people of the land—to make this a nation of neighbors.

The Federal Census of Telephones, First Taken in 1880, Has Been Supplemented since 1909 by Detailed Bell System Compilations of Quantities and Kinds of Service

Keeping Tabs on All of This Country's Telephones

Clarence W. Foss

THE A. T. AND T. COMPANY has recently taken a census too: a complete count of all the telephones and telephone exchanges in the United States.

As of December 31, 1949, the Chief Statistician's division finds, there were 40,709,000 telephones in this country, served from 17,291 exchange areas. Only 6,307 of the exchange areas enumerated were operated by the 20 companies which, together with the American Telephone and Telegraph Company, comprise the Bell System. Nearly 11,000 exchange areas, then, are served by 5,600 non-Bell companies.

Data for Bell System exchanges were available from regular year-end reports. Data for independent telephone company exchanges, however, had to be obtained from a special survey which was carried out through the coöperation of representatives of each of the System's Associated Companies.

Reports for each telephone exchange area in the country showed the type of central-office equipment used, and the number of telephones —divided between business and residence connected to that exchange. By "exchange area" is meant roughly that area within which calls can be made without the application of a toll charge. Exchange areas may be served by one central office, as is the case in the smaller communities, or by an association of several or many central offices, as is the case in large cities.

The December 31, 1949, census is the most recent survey of telephone development in the country—but the idea of a telephone census is almost as old as the telephone itself. The first census was conducted by the Federal Government in connection with its June 1, 1880, decennial census. Although the telephone at that time was still in its babyhood, it had succeeded in the four years of its existence in promising to become something more than a "toy." Indeed, serious-minded individuals were beginning to wonder if the telephone might not eventually compete with the telegraph for rapid communication. In any event, there was enough interest in the growth of telephones to include a question about them in the 1880 census.

Early Federal Censuses

TABULATIONS prepared by the Bureau of the Census revealed 54,319 "stations or telephones of all kinds" in the country as of June 1, 1880. This figure was nearly 6,500 higher than the number of telephones reported by the American Bell licensees as in service at the *end* of 1880. The manufacture and use of the telephone was protected at that time by the original patents granted to Alexander Graham Bell, and it might be expected that any count of telephones in the country would be consistent with those reported by the Bell System. However, as in the case of many successful inventions, the introduction and success of the telephone prompted infringements. It is not known whether or not the larger figure shown by the Federal census reflected the existence of telephone instruments made under infringements of Bell's patents or whether part of the discrepancy might have been due to the fact that some people considered the transmitter and receiver to be separate telephones—and thus counted one installation twice.

The next census of telephones was taken as a part of the statistics of manufactures in connection with the decennial census of 1890, also as of June 1. Here again the government count of 233,678 exceeded the Bell count as of the end of 1890 by some 5,800 instruments.

The rapid strides made by telephony were recognized at the turn of the century, and it seemed desirable that comparative statistics of telephone growth be made available for shorter periods than decades. Consequently, Acts of Congress approved March 6, 1902, and June 7, 1906, provided for quinquennial censuses of telephones. Such censuses were taken by the Government as of the end of 1902 and each five years thereafter through 1937. The 1942 census was omitted because of war conditions. Although the Bureau of the Census requested an appropriation for a 1947 census of telephones, no money was made available to it for that purpose and the 1947 census was also omitted. The enabling acts, however, are still on the books, and the question of a Federal telephone census presumably will be raised again in 1952.

ALTHOUGH the count of telephones undertaken in connection with the 1880 decennial census may not have been particularly significant, the subsequent quinquennial censuses sponsored by the Bureau of the Census added considerable knowledge concerning the telephone industry in the United States, because these censuses covered not only a count of telephones but a good deal of statistical data about investment, revenues, expenses, traffic, and similar matters. The Census Bureau had difficulty in obtaining a complete coverage of the country because of the multitude of small companies and small farmer lines and systems. In the last Federal (1937) census, small connecting lines having fewer than five telephones were not required to submit reports.

The Chief Statistician's division of the American Telephone and Telegraph Company rendered substantial assistance to the Bureau of the Census in connection with its quinquennial telephone censuses. This was given at the request of the Bureau, and included help in designing questionnaires to be used, supplying lists of service or farmer lines, and reviews and comments on the tabulations to be included in the Bureau's final report.

80,000 Telephone Companies

In the early days of telephony the American Bell Company had rather complete records of all telephone installations in the country, by exchanges. However, after the expiration of Bell's original patents in the early '90s, exaggerated stories of the fortunes made by original telephone investors led to a rush to tap the gold mine of telephony. Hundreds of independent companies and associations sprang up over night with promises of low rates for service and high dividends to investors. All in all, since Bell's patents expired, some 80,000 telephone companies have been organized in the United States. Many of them have been merged or consolidated with other companies; some still exist; but, unfortunately, many fell by the wayside because—either intentionally or ignorantly—costs of maintenance and reconstruction were disregarded when the companies were formed. Some may have been organized solely to promote the sale of stock. Certificates of stock ownership in a telephone company are frequently referred to the A. T. & T. by executors of estates with request for information as to their value. In many cases a report must be returned, after investigation, that "there is no record of this company ever having been in operation."

In spite of failures and set-backs, the number of telephones owned and operated by the independents grew even faster for a number of years than those of the Bell System. The 1907 Federal census of telephones revealed not only that the independent companies which started their operations in 1894 had about as many telephones as the Bell System, which started in 1876, but also that less than one-third of the independent telephones connected with the Bell System. In many cities and towns, two or more telephone companies were in competition for subscribers, and conditions were chaotic indeed. Businesses and professional men were compelled to subscribe for service in two systems in order to be available to their customers or clients, and individuals found their telephone to be of much less value when the people they wished to call were connected to a different system.

The management of the Bell System had available extensive records of Bell telephones throughout the country, but had only fragmentary data in respect to non-Bell installations. The idea of a universal service, whereby anyone anywhere could call anyone else anywhere in the

NUMBER OF TELEPHONES IN UNITED STATES DISTRIBUTED BY TYPE OF SWITCHBOARD AND BY STATES JANUARY 1, 1950

	Common Battery	Magneto	Dial System	Mobile	Total
Alabama	113,421	14,392	268,860	41	396,714
Arizona	29,593	3,316	115,913	56	148,878
Arkansas	100,290	27,037	114,516	48	241,891
California	440,359	44,039	3,104,131	639	3,589,168
Colorado	190,985	19,835	203,022	51	413,893
Connecticut	158,674	1,929	584,468	112	745,183
Delaware	1,470	—	107,988	28	109,486
District of Columbia	—	—	466,538	93	466,631
Florida	94,022	3,994	503,581	86	601,683
Georgia	159,158	22,620	359,820	38	541,636
Idaho	108,109	8,980	14,956	—	132,045
Illinois	1,151,645	172,629	1,610,880	774	2,935,928
Indiana	291,045	137,579	659,994	169	1,088,787
Iowa	317,656	180,956	298,171	40	796,823
Kansas	225,050	132,285	212,441	114	569,890
Kentucky	184,219	41,415	216,808	100	442,542
Louisiana	109,115	18,164	347,883	80	475,242
Maine	57,747	57,786	111,140	—	226,673
Maryland	182,193	5,764	432,818	106	620,881
Massachusetts	502,334	41,379	985,574	203	1,529,490
Michigan	290,818	105,959	1,536,762	383	1,933,922
Minnesota	267,293	96,881	509,708	112	873,994
Mississippi	110,506	12,048	88,022	—	210,576
Missouri	258,426	143,478	706,849	358	1,109,111
Montana	64,736	8,523	61,755	—	135,014
Nebraska	124,227	73,062	186,993	52	384,334
Nevada	20,346	3,283	23,377	15	47,021
New Hampshire	76,309	34,411	38,203	—	148,923
New Jersey	747,148	3,743	791,810	126	1,542,827
New Mexico	57,607	4,819	43,544	—	105,970
New York	1,118,175	92,748	3,956,721	557	5,168,201
North Carolina	115,373	10,890	380,768	22	507,053
North Dakota	35,918	24,915	58,548	—	119,381
Ohio	362,199	84,444	2,029,524	559	2,476,726
Oklahoma	249,281	62,887	232,755	329	545,252
Oregon	85,141	17,672	309,883	160	412,856
Pennsylvania	825,530	84,776	2,059,000	384	2,969,690
Rhode Island	83,722	1,402	148,572	38	233,734
South Carolina	80,925	9,814	138,079	—	228,818
South Dakota	56,336	32,752	59,288	—	148,376
Tennessee	167,688	42,451	395,647	93	605,879
Texas	399,185	114,084	1,196,705	980	1,710,954
Utah	60,793	6,699	120,217	33	187,742
Vermont	54,969	23,726	16,663	—	95,358
Virginia	124,443	17,411	507,507	126	649,487
Washington	164,159	22,381	535,133	106	721,779
West Virginia	141,421	18,238	183,822	—	343,481
Wisconsin	285,270	139,488	522,073	165	946,996
Wyoming	47,576	3,175	21,728	—	72,479
UNITED STATES	10,892,605	2,230,259	27,579,158	7,376	40,709,398

One of the tabulations derived from the Bell System's quinquennial telephone census country, could not be achieved under conditions developing in the industry. Something had to be done, and it is to the credit of both Bell and non-Bell interests that the problem has been solved over the intervening years. Back in 1909, however, the skies were not rosy, and Bell executives decided that a good start on the problem would be to take a census of telephones in each town, village, and borough in the United States, obtaining in detail the character of telephone service of each community—whether served by a Bell company, a connecting independent company or a non-connecting independent company.

A Stupendous Task

Instructions were issued in June, 1909, for the first Bell System telephone development census—to be taken as of October 1, 1909. This census was taken on a "place" basis; that is, if an exchange served more than one place, its telephones were reported for each place served. Population estimates of each place served were also requested, in order that true development ratios of telephones to population could be computed.

The census proved to be a stupendous task. Hundreds of individuals in the field labored to obtain the basic data. The absence of today's co-operation between Bell and Independent groups at that time naturally did not make the job any easier. However, detailed card records covering each place in the country served by telephones were prepared and forwarded to the Statistician of the American Telephone and Telegraph Company. He assumed the task of reviewing, tabulating, and analyzing the data for presentation to management.

At the peak of this work, the Statistician had a force of some 75 people working on the census. Detailed large-scale maps were plotted covering the country, depicting the telephone development of each place served by telephones. Summaries were prepared showing Bell and independent data by states, counties, and companies: data by size of place, data as to duplicate telephones in places served by more than one company, and like facts.

The October 1, 1909, Bell System census revealed that there were 3,414,465 Bell telephones and 3,496,371 non-Bell telephones in the country, and that less than half of the latter connected with the Bell System. It also showed that the Bell companies operated without competition in about 16,000 places, the non-Bell operated without competition in 34,000 places, and that 15,000 places were operated by more than one company. About 1,200 of the latter places were served by at least three telephone companies.

The information obtained from the 1909 census undoubtedly played an important part in assisting Bell and non-Bell managements to work together on policies leading to the abolition of duplication of telephone service.

Three additional telephone development censuses were undertaken by the Bell System prior to World War I: those of 1911, 1913 and 1915. At the close of the first

World War, plans were laid for another census, which was finally taken as of October 1, 1920. None of these censuses were as elaborate as the 1909 census, and were confined to "exchange" data rather than "place" data.

The next Bell System development census was taken as of December 31, 1924, and started a series of quinquennial censuses which has been continued through 1949. These quinquennial dates were selected to fall within the quinquennial census dates used by the Federal Government, thus providing more frequent information on an industry-wide basis. Since no Federal census has been taken since 1937, the Bell System censuses of 1939, 1944, and the one just completed for December 31, 1949, represent the only complete surveys made in the intervening years.

THE 1949 BELL SYSTEM CENSUS differed radically from the first System census of forty years ago. At the time of the 1909 census, the question of competition was paramount; in 1949 it was academic. Of the 40,709,000 telephones in the country, less than 10,000 do not connect with the Bell System, and these telephones are spread over the country in small communities in more or less isolated spots. Individual studies of these non-connecting telephones are made periodically by the Bell System companies whose territory they adjoin, in order to determine ways and means of connection wherever possible—and desired by the non-Bell company. The last case of real competition in a place of any size was eliminated when the properties of the Keystone Telephone Company of Philadelphia and its subsidiary, the Eastern Telephone and Telegraph Company of Camden, N. J., were merged with the properties of the Bell Telephone Company of Pennsylvania and the New Jersey Bell Telephone Company, respectively, in 1944.

The Bell System telephone development censuses have provided and still provide much valuable information, especially since they show telephone data on an "exchange" basis—a subdivision never attempted by the United States Bureau of Census in its quinquennial censuses. They have served most usefully to answer innumerable questions from Company officials, the Federal Government, outside agencies, and the public in general.

A Definite, Scheduled Training Program Produces Alert, Courteous, Dependable Telephone Operators, Who Provide The Best Service in the World

How Operators Learn to Give *Good* Telephone Service

James M. Clark

"Operator, get me Main 6–9000." . . . "Operator, I want to talk with Robert Singleton in Dallas, Texas. The number is Spruce 3–4768." . . . "Operator, will you please try to get Adams 8–2729? I have tried to get them but they don't seem to answer." . . . "Operator, will you get me the telephone number of William A. Judd? I think he lives on Beech Street."

These requests, with minor variations in wording, are repeated by telephone customers approximately 60 million times a day to telephone operators all over the country; and, except for conditions outside the operators' control, such as busy signals, don't answers, and no telephone listed, these customers get exactly what they ask for.

From the customer's viewpoint, fulfilling these requests seems to be a remarkably easy no-trouble-at-all matter, and that is the way we want it to be. Actually, however, a considerable amount of "know-how" is required on the part of the operating force to handle these calls accurately and speedily and with the degree of friendliness and courtesy that is characteristic of our telephone service. This operating skill is a product of the careful training which the operators receive.

The number of telephone operators requiring training throughout the Bell System is substantial. Totals vary from year to year, depending on the growth of the services handled by operators and on the replacements required for operators who leave the company for one reason or another. Recently, in one year it was necessary to train 140,000 new operators; an average over the past ten years would come fairly close to 70,000. The recruiting, interviewing, and hiring of these girls is an extremely interesting story, but here

Two new operators, with a service assistant between them, receive instruction in the fundmentals of a call

we are going to consider the usual procedures which are followed in training operators after they have been employed.*

Stages of Training

FROM THE DAY the successful applicant for the position of telephone operator enters the central office, her training is carefully planned and diligently carried out, so that she may become a capable, confident, effective, and happy member of the operating group. This is no over-night project. In fact, the various training phases extend over a fairly long period of time.

First, there is the initial training period, when the operator learns such fundamentals as to how to handle switchboard equipment correctly and how to complete the more common types of calls she will receive from customers. This generally takes from one to three weeks, depending on whether the instruction being given is for manual, dial, information, or toll operating.

Then comes a development stage, when she learns through experience to perform all these things a little better and, in addition, becomes familiar with the types of calls which occur less frequently. This interval is necessarily less definite, and may extend over a period of several months.

Finally, the last phase of training is reached—during which the operator acquires all the skill, proficiency, and knowledge that make her an alert, courteous, ever-dependable Bell System telephone operator. The operator is not actually aware of any arbitrary breaks in her training—since all parts of the program are carefully blended.

The first day for a new operator starts by meeting the chief operator of the office in which she is to work. The chief operator in turn sees that she meets the assistant chief operators, the central-office clerk, the service assistant who will be responsible for her training, and any other people with whom she will be likely to have occasion to talk and work during her first few days on the job.

* See "Hiring a Quarter of a Million Women,"—MAGAZINE, Autumn 1946.

Experience has shown that a simple, friendly gesture such as this aids in the development of a favorable attitude on the part of the new employee toward her associates and her work and, at the same time, establishes a "receptiveness" to learning. For this reason, all introductory activities are so carried out that they quickly give the new operator a sense not only of being welcome but also of belonging to the group.

A carefully worked out indoctrination program, which has complete informality as its keynote, sustains this good beginning. Even though the program must of necessity contain information regarding hours, wages, working conditions, and similar items which are interesting to all operators, they are presented to each new operator individually and not as a matter of routine or schedule. This is accomplished by taking advantage of opportunities as they arise in the normal day-to-day contacts and as they relate to operating matters being discussed. Generally, such a program of induction extends over about a year, during which the new operator becomes familiar with those company practices and policies which are of particular interest to her.

In learning the actual operating work, operators are usually trained in pairs, which gives them the advantage of being able to observe each other's work and discuss their common problems. The principal feature of this training is the use of "controlled practice operating," which is nothing more nor less than handling simulated calls. This method assures a good grounding in operating fundamentals and techniques and permits each new operating feature to be learned in relation to knowledge already acquired.

Preparing the Training Program

THE PREPARATION of a course which embodies this type of training is based on an analysis of the kind of calls customers make and the frequency of operations actually performed by the operators in the office for which the training is to be conducted. The calls and operations which occur with regular frequency are included in the initial training

Picking up a back cord

Bringing a cord into the hand

After the discussion period, the operators are ready to convert their newly acquired knowledge into action at a controlled practice session

course, while those which are encountered only occasionally are postponed until some time later.

After this information has been obtained, a master program is prepared to indicate the amount of time to be spent on each type of call or condition. The master program is based on the average time that was required by previously trained new operators to attain the state of proficiency which is desirable for this initial training. While the master program is based on averages and will prove to be satisfactory in most cases, it is by no means rigid; it can be changed as to both the time to be devoted to separate items and to total length of course—depending on the aptitude of the new operators being trained.

The training course is now prepared, incorporating the various operating steps to be learned in a sequence which permits learning the simplest call first. Each additional type of call or operating condition is then developed, step by step, in accordance with its ease of learning and in relation to previously gained knowledge and experience—until all the calls and training features have been included.

Now that the master program and the initial training course have been prepared, the service assistant is ready to begin the training of her new operators.

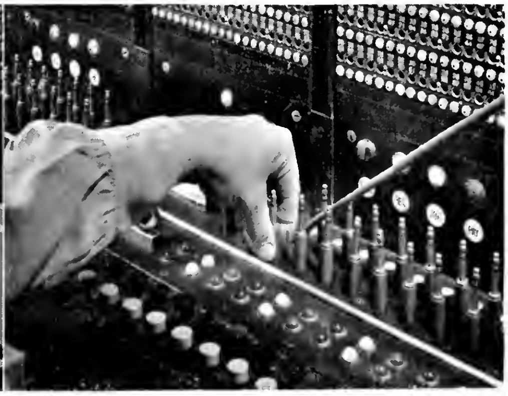
Service assistants are young women who have made the first step up from the operators' ranks. To make this step, these girls must have shown that they have not only attained a high degree of skill in all phases of operating but also have job interest, instructing ability, and that indefinable characteristic of getting along with others. These qualities are essential for service assistants, since most of their time is spent instructing and helping each of their operators to do an effective operating job. It is apparent, therefore, by the nature of their regular work and their own intimate knowledge of the operator's job, that they are in an admirable position to instruct and advise a neophyte who is learning this work.

The Method of Training

To BEGIN the actual training, our new operators are seated either at regular switchboard positions equipped for controlled practice work or, if such positions are not available—as is sometimes the case when they are needed for regular commercial operating—the operators may be placed at photographic training positions. These latter were developed during the war to take care of the training of the large number of new operators who were being employed, because regular switchboard positions were in use through most of the hours of the day for commercial traffic. The appearance of the photographic training positions and the operation of the equipment are the same as regular operating positions and they have proved to be very satisfactory substitutes for standard training units.

The new operators, with the service assistant between them, are now instructed in the fundamentals of a simple call. Through discussion and explanation, the service assistant develops what to do, and the operators perform the required actions as she proceeds. Where it appears necessary, she may emphasize or clarify a point by demonstrating what she means, but generally the new operators "learn by doing," and when the period is completed, they have covered the "why" and "how" of that particular operation. These discussions are completely informal, and

Answering a signal



Picking up a front cord

The controlled practice operator (left) has all the equipment she needs to carry out her part in the training plan

the operators are encouraged to participate as much as possible and to feel free to ask questions. Following the discussion period, the operators are ready to convert this newly obtained knowledge into action at a controlled practice session.

Controlled practice is the method which makes it possible for the new operator to acquire confidence and skill in the operations learned during discussion periods, by handling simulated calls. While the operator knows these are practice calls, from her viewpoint they are just as real as legitimate calls. She answers a signal and receives a request for a number or listing, operates with cords and keys, completes calls by means of various trunking methods. She records details and enters connect and disconnect times on toll tickets, accepts and repeats reports received from operators and customers, and performs the countless other necessary telephone operations.

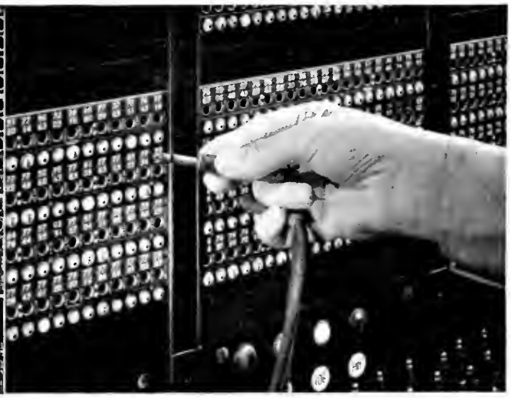
The difference between this and regular operating is merely that the calling and called customers and all intermediate operators reached are in reality just the controlled practice operator, who is pretending to be all these people and who has the proper equipment to carry out her part of this planned make-believe. The controlled practice operator can duplicate all the calls, signals, tones, and other conditions which will be encountered in actual operating, with the advantage that she is in a position to create any particular situation or call whenever she wants to. Through this procedure, it is easy to detect incorrect handling of a call or misunderstood instructions and to continue training on these items until they are thoroughly learned before proceeding to a new or more difficult type of call.

Acquiring Speed and Techniques

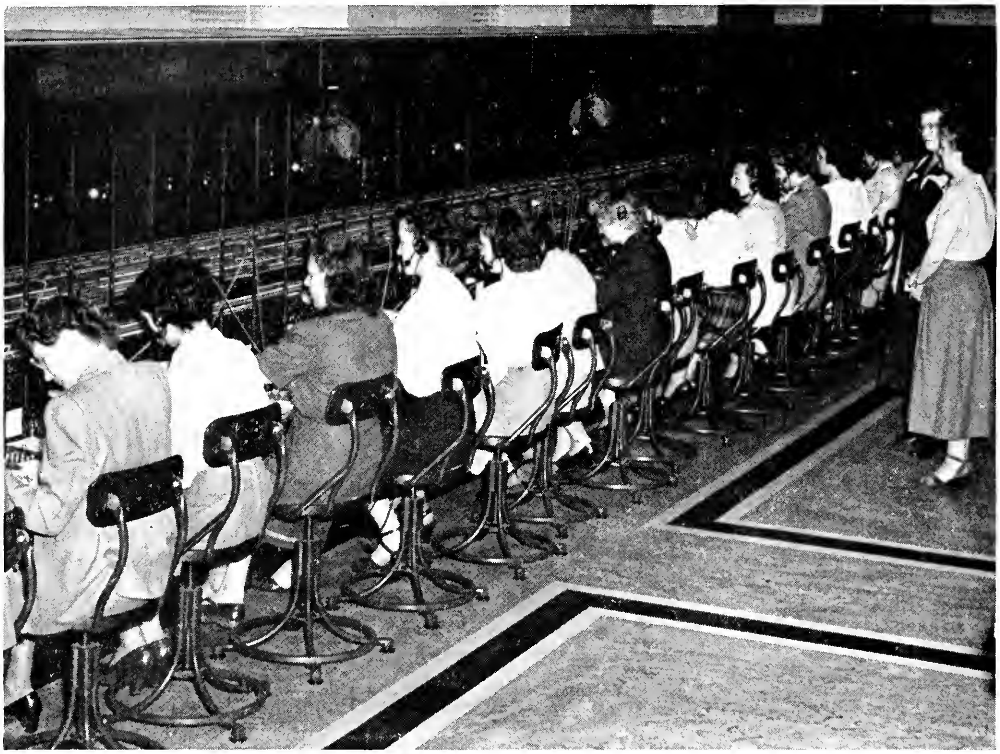
To augment the learning and skill obtained through controlled practice, particular emphasis is placed on those phases of operating where the necessary speed and proper techniques can be acquired only by constant repetition. These repetitions are called "drills," and permit the operator to concentrate on a particular operating feature and develop the dexterity desired. Throughout the training period, drills are scheduled on such procedures as the location of subscriber line numbers in multiple banks, use of keysets or dials, becoming familiar with route and rate information on reference bulletins, and similar items. It has been found through experience that several drills of short duration are much more effective than a few long drills.

Another training feature scheduled early in the course provides for the new operator to listen to the handling of calls by regular operators. This supplements the new operator's experience in controlled practice and gives her an opportunity to become familiar with the manner in which calls are received from customers in day-to-day operating. Telephone calls are made by men, women, and children, of all nationalities and from all geographical areas. The variety of voices, loud and soft, accents, brogues, drawls, and other speech differences and nuances is wide. When a new operator first listens to telephone calls being given by a cross section of these voices, almost all of them sound to her like so much jargon. Her consternation at being expected to understand these people quickly turns to amazement when she finds that the experienced operator promptly acknowledges the orders

Testing



Changing cords



Having had the initial and a good share of the development training, our two operators, no longer new, are now playing on the "varsity team"

and accurately completes the calls. Through these listening periods, however, the new operator soon finds that she too can be just as adept at understanding customers, and quickly forgets that the problem ever existed.

Within a few days after the new operator has begun her training, she has acquired through the discussions, controlled practice, drills, and listening, a considerable amount of operating information, plus the knowledge of how to handle properly a good many of the kinds of calls originating in the office. Now she is ready to try her skill at handling calls from customers. Taking her place at the regular switchboard and with her service assistant at hand, she proceeds to answer a legitimate call just as though it were more controlled practice.

While actually this is a big moment in the career of an operator, the whole approach has been designed to be very casual; and as far as the operator is concerned, this is just another step in her training. When she answers the first call, the odds are heavily in favor of her being able to handle it without assistance; but if it is a type of call with which she is not familiar, the service assistant will help her to complete it. With one call satisfactorily completed, another one is answered, then another and another—each one providing actual experience and making the handling of the next one easier and more natural.

As the training proceeds and additional operating conditions are learned through discussion and controlled practice, the new operators can handle a greater variety of calls during the commercial operating periods. Progressively more time, therefore, is spent each day on commercial operating until, when the last day or so of the initial training period is reached, almost all the time will be devoted to actual operating. Thus the new operator is not aware of any transition from her status as an operator-in-training to a full-fledged telephone operator.

The new operator is now equipped with the basic knowledge necessary to handle satisfactorily most of the calls customers will give her. However, more learning must take place before she is a skilled, experienced, all-around operator. From here on her training, although less intensive, is still well planned and administered, and is considered "development."

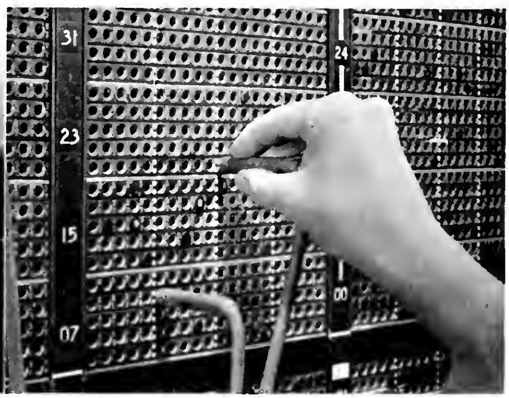
Essentially, this further training is tailor-made to fit the operator's particular needs. Normally, the new operators are assigned to the service assistant who conducted their initial training, and every effort is made to have this association continue as long as their respective tours of duty coincide. Those special or infrequent operating conditions with which the operators are still unfamiliar are now systematically introduced, until all new features of the operating job have been learned. Technically, at least, the new operators at this point know what to do and how to do it. Skill and proficiency will come through performing on the day-to-day job all the operations which they have learned.

The Tone of Service

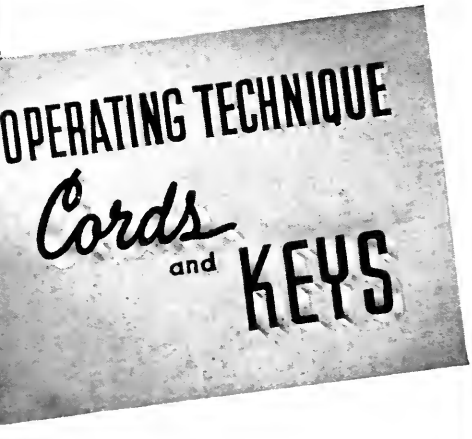
There is, however, considerably more to a telephone operator's job than technical perfection.

One of the most publicized features of telephone operating is the unfailing courtesy and friendlness of the telephone operators. These attributes are as characteristic of each operator's work as are the answering of signals and the completing of calls. When the new operator first appears in the office, she is greeted

Ringing



Disconnecting cords



These are the title frames of some Bell System motion pictures on both technical and general subjects which are shown in the course of operator training programs

›y friendly people; she is trained by ı service assistant whose genuine lesire is to help her make a success ›f her operating job; she obtains en-couragement from all her associates; ı personal interest is taken in her ›rogress and welfare by her chief ›perators and higher management ›ersonnel. In fact, at every turn he finds a friendly atmosphere and ı spirit of coöperation, where every-›ne helps everyone else. With this ›ackground, who could help but be riendly too?

To augment these normal expres-ions of courtesy and friendliness, ach office has a program called "tone ›f service" with which the new opera-or soon becomes acquainted. These ›rograms will vary by offices, but heir main objectives are to encour-.ge the operator to provide a serv-ce that is attentive, pleasing, cheer-ul, and responsive to the customer's ›oint of view.

For most operators, the attain-nent of these objectives is no trick ıt all, since their personalities natu-ally reflect all these qualities. How-ever, some operators need help par-icularly in relation to their voice haracteristics. When a girl speaks oo fast or too slowly, speaks either ndistinctly or with unusual accent ›r inflection, or has a voice with ex-remes in pitch, efforts are made to ıssist her to conform more closely to one-of-service objectives and yet re-ain as many of the individual pleas-ng qualities of her voice as possible.

This help may be in the form of lrills on the proper enunciation of elephone numbers and prescribed op-erating phrases, listening to the work ›f other operators whose voices are ›articularly good, or through the use of voice recorders. These devices have proved to be extremely helpful, since each operator, by listening to a recording of her own voice, can make a constructive analysis and can usually work out a successful solution to her own particular difficulty. It is not by chance that telephone operators the country over are characterized as "The Voice with the Smile."

Learning about Her Part In the Organization

THE MORE a new operator knows about her company, the more easily she becomes adjusted to her work, and so opportunity is found throughout the entire period of training to discuss information about the telephone business with her. The new operator learns a great deal about the company organization, its relation to the Bell System, its obligations to employees, customers, and stockholders, and similar subjects. And as she gains more knowledge about her company and its policies, she is able to understand better the reasons for many of the routines and practices followed in her office. New operators are shown excellent non-technical movies of the work of all telephone company departments, and from these are able to see how their work dovetails with the work of other operators, plant men, commercial representatives, accounting girls, and other telephone employees. Keeping operators informed about matters of general interest, and particularly about central-office items that affect them, is a continuing and important activity.

Vocational films are used in both initial and development training, and are generally scheduled in the training program at the points where the particular subjects are being introduced and discussed. For example, to illustrate operating techniques by motion picture, each step of the required action is portrayed separately and then combined into a finished operation, so that operators may easily grasp the idea being presented and use it in their own work. Likewise, movies which emphasize tone of service show the unfavorable effect of poor voice work on customers as compared with the pleased, satisfied reaction to a friendly voice. During the entire training period, the operators have ample opportunity to see, through movies, how major features of the operating job can most easily and satisfactorily be performed.

As a result of having received both the initial and a good share of the development training, our operators are now no longer new. They are regular members of the central office "varsity team," and are contributing substantially to the service requirements of the office and to the many factors which make the office a pleasant place in which to work. From time to time new practices, improved equipment features, or an entirely different type of operation may require additional training, but these become merely a part of the ever-present central office development program, and their learning is taken in stride.

It should by now be quite evident that the secret of acquiring operating "know how" rests in having a capable service assistant training a willing and receptive operator by means of a well planned and well administered training program. It is only by this combination that it is possible—and we hark back to our opening paragraph—to prepare operators to handle courteously, promptly, and accurately calls for Main 6–9000, for Robert Singleton in Dallas, to verify the busy on Adams 8–2729, and to locate the telephone number of William A. Judd. It is this kind of training which has enabled operators to furnish Americans with the best telephone service in the world. With the further development of the telephone art, it is axiomatic that training methods will keep pace.

Twenty-five Years Ago in the

Bell Telephone Quarterly

Items from Volume IV, Number 3, July 1925

America's marked preëminence in the telephone field is recognized everywhere. It has been achieved under the system of private enterprise. Private initiative has here stimulated not only a notable administrative efficiency, but also an extraordinary technical progress.

This point was emphasized by Professor Michael Pupin in his recent autobiography. He pointed out that the Bell System employs several thousand persons, at an expenditure of millions of dollars annually, in research and development work; and added that it is not so much the occasional inventor who nurses a great art like telephony and makes it grow beyond all our expectations, as it is the intelligence of a well-organized and liberally supported research laboratory. "When I think of that," Professor Pupin continued, "I am perfectly convinced that very few of the great advances in the telephone art would have happened under government ownership. That explains why telephony is practically dead in most European countries. What little life it has in Europe is due to the American research in the above mentioned laboratories." . . .

From the very beginning of the telephone industry the Bell System has given careful attention to the maintenance of cordial relations with the public which it serves. It could not be truly successful without public good will; and there has, therefore, been every incentive to earn that good will by giving the public satisfactory service and courteous treatment. The various Bell companies take pride in making public the measures they are employing to meet the ever-increasing demand for telephone service. Their plans for the progressive development of the American telephone system as a nation-wide utility are an open book. They have made known their difficulties as well as their achievements. They have successfully pleaded for public coöperation in trying times, as, for example, during the post-war period, when unavoidable shortages of equipment and of trained personnel for a time impeded progressive telephone development.

> From "Public Relations of Foreign Telephone Systems," by R. S. Coe, a former member of the Information Department.

The average man is fair and honest and is endowed with common sense. His common sense conclusively demonstrates to him that no public utility can or will go on producing and furnishing the service which he wants at less than its cost, that is, at a loss. He cannot do this in his business, and he knows they cannot do it in theirs. His sense of honesty and fairness is such that he does not wish or expect it. He is willing to pay a fair price. What he demands in return for it is good service and frank treatment. He properly resents being imposed upon. He wants to be assured that the facts are fairly disclosed to him. He is willing to accept regulatory action where that action is the result of common sense applied to the facts. He knows that in the long run this will benefit him probably more than it will benefit the utility. The notion that whatever injures the utility benefits its customers is being supplanted by the sounder rule of coöperation.

The utilities have had as much to learn as their customers. Perhaps, like the average student, neither has taken full advantage of its opportunities, but both are making progress. I believe that this better understanding of the business—this approach to understanding that the business of public utilities is subject to the same economic laws that govern every business, and that the function of regulation is not to attempt to overturn these laws but to facilitate their operation—is the most marked and most important development in the utility field today. Inevitably, its tendency is to strengthen the utilities, to aid them in their efforts to give better and more efficient service and to directly benefit all of their patrons.

From "Progress in the Utility Field," by N. T. Guernsey, former A. T. & T. vice president and general counsel.

Some interesting experiments in the use of the telephotograph service for the identification of criminals were carried on during the meeting of the International Police Conference in New York, May 12 to May 16.

The Identification Bureau of the New York Police Department had previously given some attention to the sending of pictures over telephone wires in order to get quick identification of criminals from the police departments of distant cities. This led Commissioner Enright to ask that a demonstration of the telephotograph be given for the benefit of the visiting police heads of the American cities and some forty or fifty representatives from the leading police departments of foreign countries. . .

On May 13 a committee, appointed by the Conference, selected three of the criminal records in the New York Police files, and a single finger-print of each of the three criminals, together with the established formula of classification, was sent by wire to Chief Collins in Chicago. The pictures of these finger-prints as received over the wire were identified by the Chicago Police Department without difficulty, and the full description and criminal record of the three criminals were given to the Conference over the long distance telephone lines from Chicago to New York connected to the loud-speaker equipment in the Conference room. . .

The foreign delegates expressed themselves to Commissioner Enright as being greatly interested and instructed by the demonstration of the American Telephone and Telegraph Company.

From "Notes on Recent Occurrences."

Who's Who & What's What

(*Continued from page 71*)

opment statistics, graphic and analytical studies of operations, and the personnel activities of the Division.

Visitors to a central office operating room, watching the operators' swiftly moving hands respond to the switchboard signals, are often inclined to wonder about the training which produces such competence and skill. That the training itself is also competent and skillful is evident from James M. Clark's description of the process. Mr. Clark joined the Long Island Traffic Department of the New York Telephone Company in 1923 and had served as district traffic superintendent of a number of districts and as division traffic supervisor of two Long Island divisions before he joined the Traffic Division of A. T. and T.'s Department of Operation and Engineering in 1945. For the next three years he was engaged on post-war dial service problems, and since 1948 he has been in charge of the group dealing with traffic management training and central office vocational training.

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Bell Telephone Magazine

Autumn 1950

A Medium of Suggestion & a Record of Progress

Published for the supervisory forces of the Bell System by the Information Department of American Telephone and Telegraph Co., *195 Broadway, New York 7, N. Y.*
Leroy A. Wilson, *President;* Carroll O. Bickelhaupt, *Sec.;* Donald R. Belcher, *Treas.*

Who's Who & What's What

in This Issue

THE PRESENT ARTICLE is the second contribution to this MAGAZINE by CLIFTON W. PHALEN, who is A. T. & T. Vice President in charge of Public Relations. His "How Western Electric Serves Telephone Users" appeared here just two years ago, in the issue for Autumn 1948. He joined the New York Telephone Company as a lineman in 1928, and within the next ten years he had progressed through that company's Plant Department to become division construction superintendent of the eastern division. He became division plant superintendent in the same division in 1939, and in 1943 made the shift to the Personnel Department as assistant vice president. There he became vice president in 1944, and his transfer to Vice President in charge of Public Relations of the New York Company preceded by three years his election to similar office in the A. T. & T. Company.

LIKE MANY ANOTHER versatile telephone man, J. W. ORD has had experience in both Traffic and Commercial Departments. But, unlike most Bell System people, he was born in England. He began his telephone career, in 1913, with the Bell Telephone Company of Canada and there he progressed, with an interlude of five years out for war, until he came to the A. T. & T. Company in 1926. Since then he has been, in the Commercial Division of the O & E Department, an engineer, general commercial problems engineer, sales engineer, commercial results engineer, and, since the first of this year, business office engineer. The issue of this MAGAZINE for Summer 1944 carried his "We Don't Like to Say 'No.'"

THE STUDY which KENNETH P. WOOD makes of the complex and beneficial interrelationship between a community and the telephone organization which serves

Clifton W. Phalen

J. W. Ord

Kenneth P. Wood

Harold G. Weissenberger

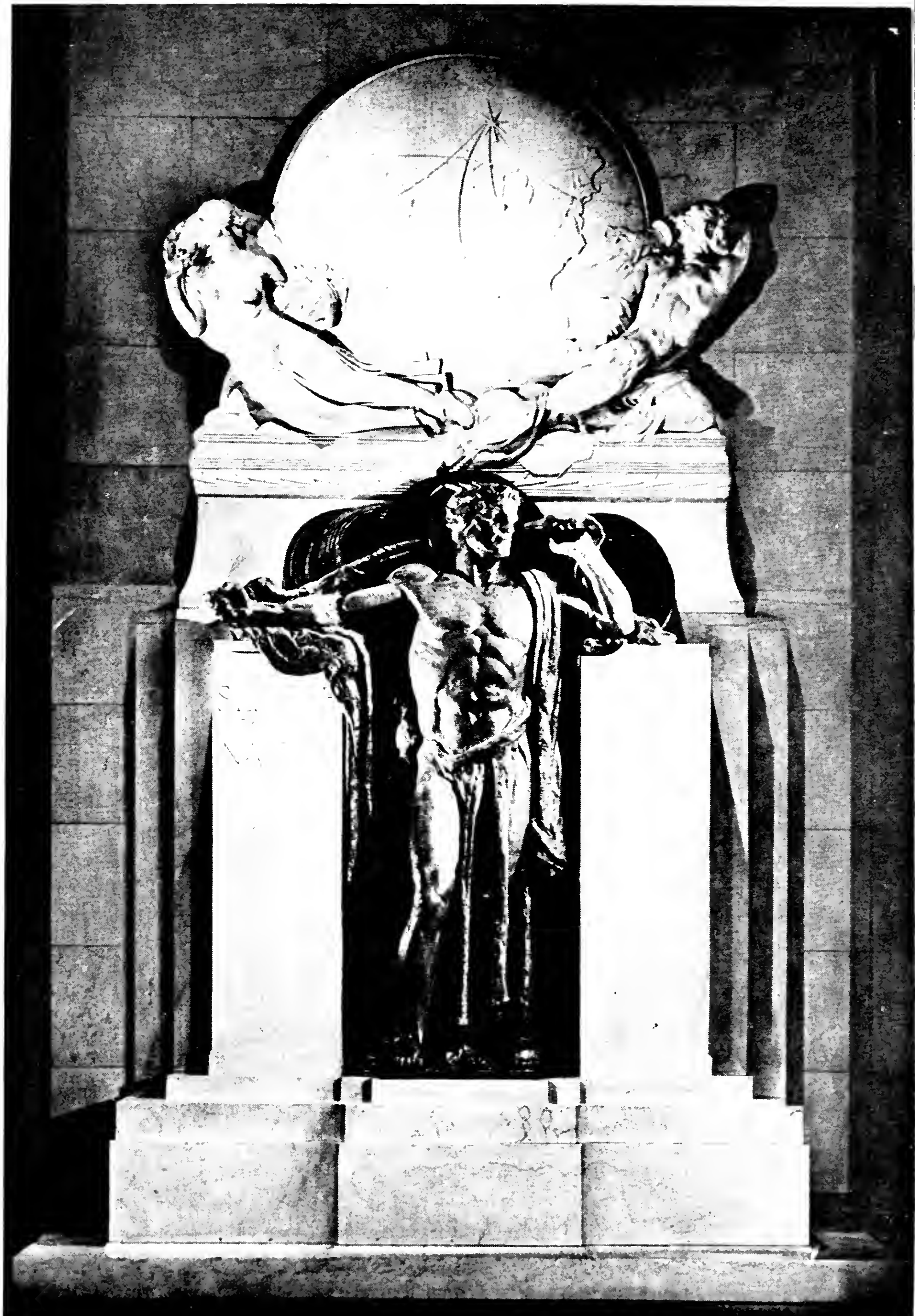
Philip H. Miele

it puts the spotlight on a situation which is much more often taken for granted than it is recognized. Beginning as a student with the Illinois Bell Telephone Company in Chicago in 1930, Mr. Wood held several positions in the Traffic Department during the next ten years. In 1940 he transferred to the Public Relations Department as employee information supervisor, and he was appointed successively general information manager, general news service manager, and again general information manager but with greatly broadened responsibilities. In 1948 he was transferred to New York as assistant vice president in charge of public relations activities of the Long Lines Department of the A. T. & T. Company; and on June 1 of the present year he moved over to the parent company's Information Department as assistant vice president in charge of national advertising and the publication of System booklets and kindred matters.

Another employee who started as a student in 1930 is Harold G. Weissenberger, who joined the Bell System in the Plant Department of Long Lines in New York. He continued his academic studies while serving as transmission man and telegraph repeater attendant, and in 1940 he moved to the New York Division Commercial office. Here he was engaged as a commercial representative until 1946, when he went to the General Office as assistant on service problems and on private line development. He transferred in 1947 to the Commercial Division of A. T. & T.'s O & E Department, where he has since been active in the sales and servicing section of the new and special services group. Certain of the photographs which illustrate his article are used through the courtesy of the press, as follows: pages 170–171, Louisville (Ky.) *Courier Journal;* page 173, lower, Nassau (N. Y.) *Review Star;* pages 174–175, Kokomo (Ind.) *Tribune.*

Newspaper reporting and radio news editing preceded Philip H. Miele's two years as a French interpreter at General Omar Bradley's headquarters in Europe. The war over, he continued his education, and graduated in economics. Since 1945 he has been with the Information Department of the Western Electric Company, where his assignments have included such matters as press relations and,

(*Continued on page 192*)



Symbolizing the Bell System's readiness to serve under all circumstances, this bronze and marble group stands in the lobby of the A. T. & T. headquarters building at 195 Broadway in New York

The System's Capacity to Serve Has Doubled Since the Start)f World War II. Much Work Is Still to Be Done, but Good Progress Is Being Made

Bell System Well Prepared For National Emergency

The following is the text of a statement made public at the end of last September. EDITOR.

THE BELL SYSTEM is well prepared to meet the present emergency. he plant is twice as large and greatly improved over ten years ago. ew methods of communication, not even in the plant at the start of Vorld War II, have been introduced and are being used extensively. he skills of telephone men and women were never so far advanced as hey are today.

There is, however, more to be done—both in providing service to hose who are waiting and in meeting the demands of the present emer- ;ency. Telephone men and women realize the nature and importance f the job that lies ahead. Plans have been made, and the Bell Sys- em is moving right ahead with the work.

IORE THAN a billion dollars a year as been spent by Bell System Com- anies since the last war to expand nd improve the nation's telephone ommunications network—an impor- ant part of the strength of the whole ountry.

The number of telephones in serv- ce has doubled since 1940 and now tands at 35 million. Of these, 74 ercent are dial operated, as com- ared with 59 percent when World Var II started.

Bell Telephone employees are now 600,000 strong. Like the plant they operate, their number has nearly doubled since 1940. With the experience gained in hurricanes, sleet storms, fires, and other disasters, they have the ability and spirit to handle future emergencies that may arise.

In the last few years, great strides have been made in extending and improving long distance service. Thousands of new circuits have been added, but today's high calling rates mean that many more must be built into the plant. New methods of making long distance calls have been developed, installed, and expanded.

"Operator toll dialing," coaxial cable, and radio relay are examples of new developments. Today, one-third of the long distance calls in the United States are "dialed" directly by switchboard operators. There are three and one-half million circuit miles of coaxial cable in operation. Fourteen radio relay networks, totaling about 8,000 channel miles, are in service along heavily-used long distance routes. A transcontinental route is scheduled for completion next year. Both coaxial cable and radio relay are vital links in the nation's communications network. In 1940 these services were only in the experimental stage.

Another new development is mobile telephone service—also a valuable asset to the nation's emergency potential. Ten years ago only one city in the United States had this service; today there are 140. Portable emergency radio-telephone units are also available and are located at over 100 strategic places. In the event of bombed-out facilities, they can be used as a bridge to the nearest operating long distance circuit.

Much is being done to make telephone plant and property as "trouble proof" as possible. Safeguards are being taken to prevent access by unauthorized persons where important mechanical equipment is housed. Key manholes have been locked. Emergency power supply has been provided in substantially all locations. Telephone employees have been alerted to the possibilities of sab[o]tage, and the importance of the se[c]recy of communications has bee[n] reëmphasized.

Telephone traffic control burea[us] have reviewed their rerouting pra[c]tices in the event of sudden loads o[r] emergent situations. Routes for lon[g] distance traffic, river cable crossing[s] and important sections of exchang[e] cable are being carefully scrutinize[d] to insure that alternative routes a[re] provided where needed. Special em[]phasis is being given to militar[y] locations.

Emergency telephone restoratio[n] plans are being established in ke[y] cities. Facilities in communitie[s] around the perimeter of these citie[s] are being rearranged and new route[s] provided so as to tie in directly wit[h] substitute long distance centers in th[e] event that the normal city toll cente[r] is bombed out.

Against this background of greate[r] capacity, new equipment and meth[]ods, and experience in protectin[g] and maintaining service, the Bell Sys[]tem is squaring away to the still big[]ger job ahead—the responsibility o[f] meeting the growing needs of th[e] government for defense and militar[y] purposes. How big that job may be[]come, no one can foretell. But prog[]ress has already been made, and th[e] Bell System will continue to serve th[e] nation with every resource at its command.

The Telephone Companies are coöperating closely with the govern[]ment on many special communications projects. Important among these is the provision of telephone facilities for the Air Defense Communication System, or "radar network." Work on this is well under way; more is scheduled.

Thousands of miles of private line networks have already been provided to the military. Also, it is the job of the Bell System to furnish local and toll facilities to widely scattered military bases and training camps over all the country. This is a big job—it will require much construction—but the System is moving ahead with it.

The Telephone Companies are working closely with civilian defense authorities on disaster plans, and on defense warning networks. Local telephone people have assumed key responsibilities in these projects. The existing nation-wide network of long distance circuits will be of immeasurable help in coördinating the national civilian defense job.

During the last war, the Western Electric Company, the Bell System's manufacturing and supply unit, was the nation's largest producer of gun directors, radar equipment, radio and telephones and switchboards for military use. Western worked in close coöperation with Bell Laboratories, which completed over 1,200 military projects. These organizations—with the skill and know-how developed in two World Wars and with years of telephone experience—are again coöperating closely with military officials in many important activities.

In sum, a great deal of work has been done, but the job ahead is important and very considerable. Times like these emphasize the benefits of past growth and the value of a strong, healthy telephone company to serve the country's needs. The vast challenge of contributing to the security of the nation must be met. In meeting that challenge, the Bell System is moving ahead with confidence, based on the fact that this country already has by far the best telephone service in the world—furnished by a seasoned organization of service-minded men and women.

Friendliness, Sincerity, and Integrity Are Qualities Which Add a Plus Value to Telephone Service

The Kind of Service Our Customers Want

Clifton W. Phalen

The Bell System exists to serve people, and serving people seems to me to mean giving them what they want—in our case, the kind of telephone service they want.

My own belief is that the public look to us for about three things.

First, I am sure they expect a technically high-grade telephone service. They want fast service, they want to hear and be heard easily when they talk by telephone, and they want to feel that the service is dependable—that they can count on it whenever they need it. In fact, most people have come to take these qualities for granted.

One reason for this is that we have, by providing technically good telephone service over the years, educated the public to expect that kind of service as a matter of course. In addition—and this seems to me an important factor—industry in general has done such a good job that people have become accustomed to technical excellence in most of the things they buy and use. They aren't inclined to accept failures or shortcomings. On the contrary, when a person gets used to a high standard, it's easy for him to be critical of anything that isn't quite up to par. This means that our service must continue to be extremely good, in a technical sense, if we are successfully to stand comparison with other industries.

People Are Used to Seeing Things Improve

The second thing our customers expect from us is closely related to the first: they want a service that is not only good but is constantly getting better. And here again the public's expectation is based on observation and experience with other industries, as well as on experience in using the telephone.

Of course, the average man today buys better telephone service—much better—than in years gone by. He also buys and enjoys better automobiles that run on better gas and roll on better tires. His wife has a better washing machine that uses better soap. They both listen to a better radio and watch television on a better set than they could have bought only a short time ago. They use new household utensils made of new kinds of plastics. Their clothes and perhaps their curtains and rugs are woven from new kinds of yarns, and there's more white meat than there used to be in the average chicken dinner.

In short, the public are practically bombarded by improvements coming at them from all directions. And they would think it strange indeed if their telephone service did not improve through the years along with everything else.

Fortunately for everyone, the record of telephone service over three-quarters of a century is a record of steady and remarkable progress. We have always been well up front in the progress parade and that is where we expect to stay.

Our progress is the kind that catches the ear, so to speak, rather than the eye, for we don't introduce a new and shinier model each year. Indeed, one of the challenges that forever faces our scientists and engineers is that all apparatus must be so designed that today's newest tele-

Constant vigilance at the test desk plays an important part in maintaining the dependability of telephone service

Use of mobile radio telephone service has been extended from one city to 140 in the last decade

phone transmitter can work perfectly through a last year's switchboard and a section of pre-Pearl Harbor cable.

But 1950 telephone facilities and service are measurably ahead of 1949's in many respects, and so far ahead of 1925's that the latter are not much more than basically similar. Many of us are already familiar with the long record of telephone pioneering. Step by step, year by year, the range of service has been increased and hearing made easier, connections have been put through faster and facilities made more convenient and dependable. But we don't need to recall past history to get the evidence of progress. It is all around us today.

For instance: Three-quarters of the Bell System's telephones are now dial-operated, compared with two-thirds at the end of the war. The average telephone now is out of order only about once in two years—half as often as a few years ago. Operators today are dialing about a third of all toll and long distance calls straight through to the distant telephones, and the proportion of calls handled in this way will continue to increase. Local calling areas are being enlarged, customer dialing of toll calls is also on the increase, and automatic message accounting systems are being installed that will permit more and more telephone users to dial their own calls to out-of-town points. Telephone service for automobiles, trucks, and moving trains has been transformed from a plan to a reality. An improved telephone instrument, which talks more clearly, rings more pleasantly, and is easier on the eye, is out for test. Service for farmers and for all in rural areas is being vastly expanded and measurably improved.

These are just a few current and conspicuous examples of the forward march of telephone service, and they illustrate the improvement that our customers have learned to expect.

Friendliness, Sincerity, Integrity

When people receive a technically good and ever-improving service, one might ask what more they could want. I think the answer is plain. There is a third desire which the public feel—one that springs from a deep-rooted aspect of human nature. It affects not us alone, but pretty much all service businesses, and it has a value that would be hard to overestimate.

People like to be surrounded by other people who are friendly, pleasant, easy to get along with.

People like to deal with other people who take a sincere interest in their problems, and who are willing to give them a little special attention.

People have respect and admiration for straightforward dealing, upright conduct, integrity.

Friendliness. Sincerity. Integrity. Intangible they are, but remote from the telephone business they are not. For if our customers admire

A group of friendly and pleasant people, visitors at a Telephone Company "Open House," are enjoying their guide's explanation of "Information's" function

Bell System drivers, courteous as well as careful, are often good friends to meet on the road

and respect these qualities in their friends and associates, they will also admire them and be gratified to find them in a business such as ours. When we render a friendly, courteous, trustworthy service, we are responding to a basic desire of the people we serve. And it is perfectly natural for us to respond in this way, for telephone men and women, like any good citizens, are naturally inclined to be courteous and friendly and upright. Therefore it is not a difficult job to make those qualities apparent in our day-to-day activities.

Opportunities to Serve Our Customers

WITH 19 BILLION personal contacts between operators and customers in the course of a year, think of the opportunities to demonstrate that "The Voice with the Smile" is no catch phrase, but a cornerstone of our service philosophy. Most of those contacts may be limited to "Number, please . . . Thank you"; but each one is personal, and a friendly tone of voice is always good to hear. And this is true of every kind of call—the local and long distance calls, the calls to "Information," the calls which connect with intercepting operators. All can reflect the warmth of a friendly desire to please.

That is the kind of service, for instance, which could bring a spontaneous letter of thanks to the president of one of our companies "from my mother and self for the courteous and very efficient service rendered us 'by telephone' over the past 40 years" . . . and for the "courtesy and kindness that come 'over the line' . . . making life less difficult and at times happier."

IN ALL PARTS of our business and in all kinds of jobs, the acts by which courtesy, friendliness, sincerity, character are expressed are as individual as the people who perform them. Yet there is a common denominator of good will in all.

"What a pleasure it is to do business that way," wrote an Army officer who had occasion to visit a telephone business office. And of the service representative who took care of him he reported that "she had all the desired information at her fingertips and . . . seemed very happy to help in any way."

No less "happy to help" was a man employed in a telephone business office who was able to assist a customer in a different way. When a bulldozer out of control ripped down the telephone circuits between the city where he worked and a nearby suburb, he and a colleague hurried to the suburban central office in a company automobile equipped for mobile radio telephone service—over which emergency calls could be made. While testing the lines in the suburban office, the other man picked up what seemed to be an emergency call. The customer's voice was faint, but he was able to make out her number, and told her somebody would call her right back. The business-office representative made the call at once, by the radio telephone in the car, and was answered by a woman whose baby was ill and who was trying frantically to reach her doctor in the city. The representative offered to make the call for her, but she felt that she must speak with the doctor herself. He then invited her to come to the central office and use the radio telephone in the car; but the customer, increasingly upset, replied that she would have to drive to the city and talk with the doctor there. Realizing that the woman was greatly disturbed, and was preparing to leave her sick child alone for a considerable period, the telephone representative offered to drive the telephone-equipped car to her home. She welcomed this offer, and he had the car before her door in short order and proceeded to establish the connection

In the business offices, courtesy and sincerity go along with a thorough understanding of the tangible elements of good telephone service

Telephone operators have literally billions of opportunities in the course of a year to show that "The Voice with the Smile" is a warm and living concept

to the doctor for her. She then talked directly with the doctor, via the mobile radio telephone, and not only obtained the information she needed but was reassured because it had not been necessary for her to leave the child alone.

ACROSS THE street from a telephone company supply yard lives a little boy, who watches with lively interest the comings and goings of the Plant men whose base it is. He hasn't had much else to do, because he is bedridden—but he has more to amuse him now. For when the men found out about him, they bought him a phonograph and some records — despite the fact that there is nothing in Plant Specs which covers that particular situation.

Nor is there any specification which requires a telephone man to stop his car or truck on the road to help somebody who is having difficulties. But they do it often, and so demonstrate their own good will and win more of it for the Company. To one customer, a college professor, such an instance was evidently the culmination of many favorable impressions, for he wrote: "We have recently changed to the dial system in our little town. When the man came to install our phone, I just thought how fortunate we are to have a great company interested in really serving the nation, and of how little each person really pays for all the expense involved in keeping such an intricate communication system going. Then just this week my wife ran the car into the ditch accidentally. A lineman came along and courteously offered his assistance. . . . Your lineman need not have stopped, but he did, and thus exhibited the courtesy and efficiency which are a part of your great corps of workmen. . . ."

THE traditional spirit of service of

the telephone operator finds its expression in many ways—some of them dramatic, others just kind. An instance of the latter was given by the service assistant at an attended telephone location in a big railroad station who noticed a youngster, forlorn and in tears, in a telephone booth. When she found that he had missed his connection and felt lost, she called his mother and assured her the boy would be on the next—and right—train. But it brought a letter to the Company from the boy's father in which he said: "When you have employees going out of their way to aid in the personal problems of a customer, I feel it worthy of commendation. May I extend through you to Mrs. ——— our deep appreciation?"

Another incident with a happy ending was a town official's urgent search on a Sunday afternoon for a source of anti-rabies vaccine. While he was able to give the telephone operator the name of the concern and of the city in which it was located, he put into her hands the problem of finding on a Sunday in Spring somebody who was authorized to accept an emergency order and make a speedy shipment of the vaccine. The operator got her man, promptly, and the relieved town official wrote to the Telephone Company to express his gratitude to her. He added, "We are apt to get in the habit of expecting exceptional service without being properly grateful to employees and concerns which render such service, but in this case I do wish to thank everyone who helped and I know the doctor and his patient would wish to join me in this expression."

The point illustrated variously by these instances is clear enough. The operator or the Plant man who makes a little extra effort, the business-office service representative who makes sure she understands the customer's problem and then follows through carefully to a successful outcome—it is the combination of thousands of such actions of all kinds, little and big, thoughtful, courteous, character-full, which give our business its reputation for warmth of heart as well as for technical excellence of service.

When we provide—as we do—a telephone service that is very good by technical standards, and is also constantly improving, we undoubtedly win the respect of our customers. But when we add to our technically good service the important qualities of friendliness, sincerity, and integrity, we gain something more, which is the friendship of the public. And in so doing, we add interest and fun to the job and gain a greater satisfaction from our daily work.

Proof of the Pudding

What I am talking about can't be fully expressed in statistics. But the statistics we have do indicate that there is a direct connection between the way we treat our customers and the way they feel toward our company—that people who feel they have been treated in a friendly and courteous manner feel also that the Company's general reputation is good. In our customer surveys, for instance, we ask people whether they are treated by telephone people the way they like to be treated. Of all the people who answer "Yes," 84 percent say that the Telephone Company's reputation is excellent or good. Of those who answer "Sometimes not" to the question, only 38 percent say that the Company's reputation is excellent or good. It looks like more than a coincidence.

A frequently heard comment from members of the public, when telephone service or the telephone business is under discussion, runs something like this:

"We can understand how you folks do the good technical job that you do. But the great thing to us is that in a business the size of yours, with the tremendous number of employees you have, your people are so friendly and so courteous. It is a wonderful way to do business, it seems to us, and one of the greatest public relations assets you could have."

The very fact that this kind of comment occurs so often indicates that a great many people are genuinely impressed by what we are doing.

It also indicates the rightness of our continuing efforts to deal with people on the simple basis of friendliness, sincerity, and integrity.

A POPULAR FEATURE of Chicago's Lake Front Fair was the telephone exhibit, called "The Bell System Presents . . . The Telephone of Tomorrow," which attracted more than a million visitors.

At the conclusion of a demonstration of the intricate Automatic Message Accounting equipment, the Illinois Bell girl who had given the demonstration noticed a woman still standing by the exhibit.

"Have you a question?" she asked.

"I certainly do, young lady!" was the reply. "Tell me, if this is such marvelous scientific equipment, why wasn't it invented years ago?"

After the demonstrator had tried bravely to answer that one, the woman, still unconvinced, left the exhibit with this parting gem:

"You folks are so far ahead in some things and so far behind in others, why don't you just stop everything until you get caught up?"

Equally puzzled was the large and elderly colored woman who approached the voice-mirror equipment but who appeared hesitant about using it. The telephone attendant invited her to try it, but she replied bashfully that she wouldn't know what to say. He offered various suggestions, and the woman finally agreed that she would speak her address.

Into the microphone she then said "Ah lives at 1234 Such-and-such Street, heah in Chicago."

There came back to her, of course, her own voice and words: "Ah lives at 1234 Such-and-such Street, heah in Chicago."

Her eyes widened as she listened, and a smile came over her face. "You do?" she exclaimed. "Mah goodness—we must be neighbors. That's where Ah live too!"

The Objectives of Bell System Business-Office Service to Customers Include Courtesy, Understanding, and Helpfulness In Addition to Efficiency

"Business Office—Miss Smith Speaking"

J. W. Ord

If you were to ask Miss Smith, a service representative in the business office of a Bell System Company, about her work, she would probably tell you something like this:—

"I am a service representative handling a group of about 2000 customer accounts, and it is an interesting and challenging job.

"I keep the records of these customers' service.

"If they have some business matter they want to discuss with the Company, I handle it.

"Their telephone calls and visits may be about all sorts of things: inquiries about rates, orders for service, some question about a bill, or a difficulty they want adjusted.

"If they want information, I either give it to them or see to it that someone else does.

"If they want something done, I take care of it or make sure it gets the proper attention.

"I am also responsible for the collection of these customers' bills.

"My job requires me to deal with the other departments of the Company and to know quite a bit about what they do.

"There is a lot of variety in my work. That is one reason why it appeals to me. Another is that I like dealing with people and helping them.

"I feel I have much responsibility, and opportunity to use my own judgment."

Why is this business office job so appealing to Miss Smith and her thousands of colleagues? It is largely because of the Bell System's concept of the place of the business office in telephone company operations, the high standards set for its service and customer relations and what is done to insure meeting them.

A challenging feature of the service representative's job, which helps to make it particularly interesting, is the great variety of matters she is called upon to handle for customers

Vhere the Business Office Fits In

[HE BUSINESS OFFICE has been esablished as the place for customers o get in touch with, as one Bell tele›hone company tells them in the tele›hone directory, "to arrange for hanges in your service; answer quesions about your bill; furnish infornation on other telephone matters or ıelp you in any service difficulty which ıas not been taken care of to your atisfaction."

The business office also has other unctions which are handled by other mployees, and not by service repreentatives, such as handling payments rom customers, coin telephone colection work, and typing of orders or service.

The Bell System believes that only he best possible handling of business›ffice contacts is satisfactory to cusomers. The volume of these conacts alone would make them imporant: some 85 million a year, with 25 nillion telephone customers, handled ›y 17,000 service representatives. 3eyond any quantitative measure is he matter of the character of these ontacts and the reaction of custoners to their handling. A wide ange of subjects comes up in these ontacts—one study showed 200 diferent topics in each 1000 contacts—nd customers generally feel that the ›usiness office is speaking for the Company, reflecting the policies of nanagement and its interest in its ustomers.

Customers will not think the busiıess office effective unless they feel hey have achieved their purpose in alling on it. Here arises an interestng situation, because the service repesentative must often get in touch with another department for information or to get the proper action to meet a customer's request. If customer achievement of purpose is to be assured, there must be good interdepartmental teamwork. The service representative must know enough about other departments' operations to be able to recognize when they are involved, to understand what the other department needs to know in order to do its part, and to keep in mind what that department can be expected to do.

THE COMPLETENESS and accuracy with which service representatives obtain and transmit to other departments the information necessary for them to understand properly and carry out customers' wishes or orders for service have a substantial effect upon the accuracy of the departments' records and operations. Accuracy in transmitting information about an order for telephone service, for example, can directly affect the accuracy of billing, directory listings, and type of service installed, or the keeping by installers of appointments with customers.

Another aspect of interdepartmental teamwork concerns the support given the business office in its role of spokesman for the Company. Where, as is often necessary, the service representative holds the customer on the line while she telephones another department for information, the employee answering in the other department should be as alert and prompt in furnishing the desired information as if talking directly to the customer. In addition, all employees concerned, whether in the business office or not, must consider a commitment made by a service representative to a customer as one made by a representative of management—as indeed it is, especially from the customer's viewpoint.

Philosophy of Service

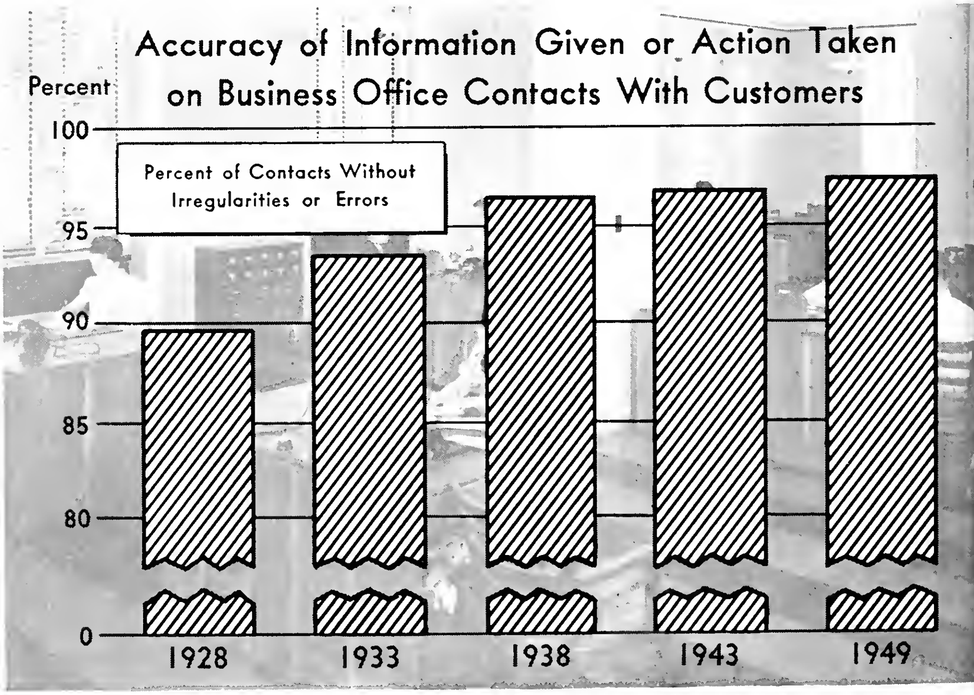
THE IDEAL of a high quality service has, therefore, been set for the business office. It must be translated into a reality through the medium of people: people who, day by day, deal with other people. Reality has been made practicable by developing out of continued study of experience specific standards of service which have been codified for the guidance of service representatives.

These standards start with the proposition that service should be accurate and complete with respect to information given or action taken.

Service should also be prompt, particularly in two respects: (1) cus tomers should receive prompt atter tion when they call, visit, or write th office; and (2) if a customer is hel on the line while the service repre sentative consults her records or call another department, the representa tive should return promptly to th line and not keep the customer wai ing and wondering what is happening

These are what might be called th technicalities of good service. The promote efficiency. But an organiza tion can be efficient and yet not b considered by the public as friendly human, and helpful. It might ap pear, for example, distant, arbitrary or machine-like.

This suggested consideration c how people like to be treated an continuing study along these lines ha resulted in an approach known a "Overtones of Service." During th last war it proved so stimulating i



nproving the handling of contacts hat there has been most intensive evelopment of it as an aid in train- ıg and inspirational leadership.

The overtones approach focuses ttention upon several elements.

Courtesy is, of course, essential but : must be natural and sincere.

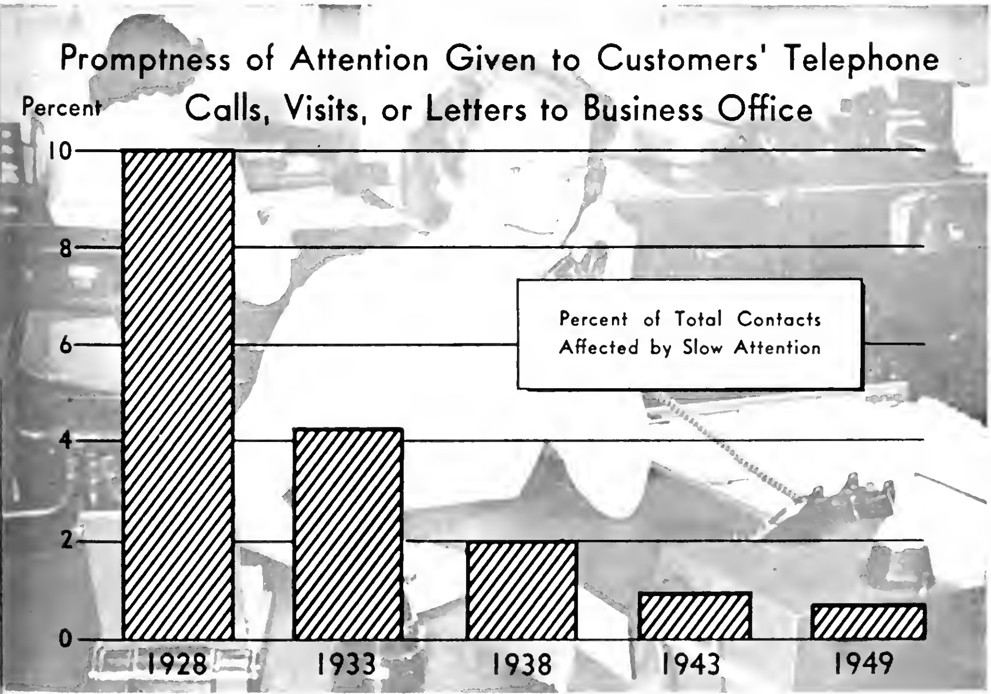
People like to receive individual ttention as opposed to routine reatment.

Customers' contacts should be so andled that they feel it is easy to et an understanding and sympathetic earing of their situation or difficulty rom the telephone company. This ıcludes recognition of unusual situ- tions warranting action beyond the ormal routine and avoiding giving ustomers the impression of being ıet by an arbitrary rule without re- ard for their individual problem.

It is important, of course, that the ustomer properly understand the Company's viewpoint, particularly where his request cannot be granted for some good reason. No matter how good Company operations and practices are, they sometimes require careful and clear explanation to be properly understood and appreciated as reasonable. This also applies to discussion of the effect of some condition beyond the Company's control—war or storm or some other emergency, for instance—when the customer might not otherwise realize what is confronting the Company and what steps the Company is taking.

Telephone contacts warrant special consideration, since the customer cannot see the service representative and forms his impressions largely from her voice and manner.

Of outstanding importance is to handle all contacts in a spirit of helpfulness—a sincere and evident service attitude.



SERVICE ITEMS	OBJECTIVE
SPEECH	Clear and distinct—simple straightforward language—"Voice with a Smile"
COURTESY	Good manners and business etiquette—natural, spontaneous and sincere
UNDERSTANDING THE CUSTOMER	"Tuning in" with the customer—making sure his request and point of view are fully understood.
QUALITY OF EXPLANATIONS	Making sure that the customer understands our explanation and feels that the Company's handling of the matter is fair and reasonable.
SERVICE ATTITUDE	Sincere interest in serving the customer and alertness to all opportunities to be genuinely helpful.

Overtones of Service objectives in business office contacts with customers

This "overtones" approach is not a cloak to be put on or taken off at will. It must be a motivating spirit in the conduct of the job.

To insure that these high objectives are given practical day-to-day application, the service philosophy has been woven into the processes of selection, training, and supervision. In addition, a plan has been established for the continuous analysis of the quality of service being rendered in handling contacts with customers, from the standpoint of good overtones as well as accuracy and promptness. This has proved most effective in maintaining the interest of the force and insuring that full advantage is taken of opportunities for improvement.

Collections

THE BUSINESS OFFICE is responsible for collecting customers' bills,* as Miss Smith said. Success in collections is just as vital to the large telephone company as to the small business man. Currently, about a third of a billion dollars must be

* See "You Can Tell by the Teller," MAGAZINE, Spring 1949.

collected each month—much, although not all of it, of course, consisting of relatively small bills for the 21 million residence customers. Most customers pay their bills when due; but for one reason or another some do not pay on time, and, while the percentage who don't is not great, the amounts involved can add up to substantial sums.

In establishing rates for telephone service, the Company assumes that bills are paid promptly, and it is also quite important that uncollectible or bad-debt losses be kept to the very minimum. Good customer relations require that this collection work be done with the least possible irritation to customers and in a manner which is considerate and respectful, yet businesslike and, where necessary, firm.

Since the collection job is a sizable one, it cannot be permitted to lag. Yet there is no intention of handling collections on an assembly line basis and everything practicable is done to assure individual attention to each customer's account. One reason why work in the business office is so organized that each service representative is given charge of a specific group of customer accounts is to facilitate getting a personalized collection job done and featuring an important point—promoting the habit of prompt payment without reminder.

As every business man knows, much business judgment is necessary in collection work; it cannot be done sensibly just by following a list of iron-clad regulations. Dealing with all kinds of customers under all manner of circumstances raises many a delicate question, such as—should we require a deposit on this account; how and when shall we approach this customer to pay his overdue bill; how should this request for an adjustment be handled; should we grant this request for extension of time in which to pay the bill; or how can we collect that final bill? The judgment of individual service representatives grows with experience but a good deal of effort goes into developing their ability to arrive at sound business decisions, combining good collection and good customer relation judgment.

Problems of Facility Shortages

Unusual operating or facility conditions, such as prolonged shortages of telephone facilities, may afford a very severe test of the business office in dealings with customers.

During the severe facility shortage of World War II and operation under the War Production Board limitation order U-2, the service representative group did an outstanding job.* In the face of extremely difficult conditions they so handled contacts as to insure customer understanding of the situation, confidence in the Company's handling of it and recognition of its continued interest in customers even when it could not fill their orders.

This test did not cease with the end of the war. During the eventful post-war years, the Companies have been confronted with an unprecedented and continuing demand for service. To meet it, the System has undertaken the biggest construction program in its history—and the largest peace-time program of any private enterprise—spending well over

* See "We Don't Like to Say No," Magazine, Summer 1944.

five billion dollars for the expansion and improvement of service. As a result, telephones in service have been increased by about 13 million. The waiting list has been reduced to very small proportions—usually about two percent of all telephones in service—although there are some places where demand for service has persisted at such high levels that somewhat more delay in furnishing service has unfortunately been unavoidable.

In order to keep to a minimum the number of customers waiting for service, the Companies have tried to serve as many people as possible with existing facilities. They have asked new customers to take party-line service and existing party-line customers to retain it. This has seemed the most equitable thing to do under the circumstances—although it is fully recognized that party-line service doesn't fully meet everybody's needs.

The post-war years have thus brought to the service representatives a double challenge. They have had to so handle contacts as to maintain the confidence of applicants for service by assuring them that, despite the delay in furnishing it, the Company is doing a tremendous job in furnishing facilities as fast as possible, and that, as facilities become available, service is furnished to each applicant strictly in his proper turn. At the same time, service representatives have had to make the facts of the party-line situation clear to customers who want a better grade of service. With such large numbers of customers on party lines, the service on party lines must be made as satisfactory as possible. For this reason, the Companies have been quite active in many ways in encouraging party-line customers to be considerate of others in their use of the line, and service representatives help by discussing party-line coöperation with customers on lines where difficulty is reported, a

Yesterday's customers stood at counters in public offices to transact their business with the telephone company

Today, public offices afford greater convenience and privacy for customers, who can transact business while seated at representatives' desks

matter sometimes calling for much diplomacy.

It is a tribute to the sincerity of purpose of service representatives and to the leadership of the supervisory organization that despite the continuing high demand, the length of time shortages have lasted, and the large volume of orders and inquiries handled (over 35 million a year), the interest of the group in customers and their telephone needs has been fully maintained.

Selection, Training and Supervision

Service representatives must be selected with great care. The first requisite is to subscribe wholeheartedly to the Company's philosophy of service. Service representatives require an unusual combination of qualifications. They should have the ability to absorb and remember a wide range of information, express themselves well, and have a good telephone personality. They should like to deal with people and be helpful. Patience, poise, alertness and quick understanding of the other fellow's viewpoint are necessary, as well as accuracy, clerical aptitude, and some skill in mental arithmetic.

Experience has shown the desirability of avoiding any tendency to "type" the business office force, as happens when recruiting is largely confined to any one source. To the contrary, there are advantages in having a group with mixed backgrounds as to education and previous experience (drawing upon various telephone departments as well as outside business). Association with such a varied group helps to develop a service representative's flexibility and understanding of different points of view and other department operations. Such acquired qualities are most helpful in improving her ability to talk to all kinds of customers on a wide range of telephone company matters.

While much of a service representative's success depends upon her own natural ability and judgment, it is a matter of System policy to help her to develop both to the full extent of her inherent capabilities. Before being assigned regularly to her job, she takes an initial training course, of about six or seven weeks' duration, spent partly in the classroom and partly in learning by doing. The length of the course is governed by the amount of knowledge to be acquired and the need for practice in the best service and contact techniques in dealing with customers. Students of contact techniques will be interested in knowing that naturalness of expression is sought and the use of standard phraseology or "canned contacts" is discouraged.

Helping service representatives does not stop with initial training. One of the principal responsibilities of the business-office supervisors—to whom service representatives report—is to continue to assist them with the further development of their ability and judgment. The opportunity to graduate into and beyond this supervisory job provides a stimulating incentive to the ambitious telephone career woman.

For good service and economical operation, there must be an adequate but not excessive force on duty to handle the volume of work. Service representatives generally agree that they do their best work when reasonably busy. If representatives are too busy, the quality of service may be adversely affected—particularly accuracy, overtones, and personalized attention to collections. A plan has, therefore, been developed for measuring the volume of the different kinds of business-office work in terms of a common denominator known as work units. This has been made possible by the development, for each class of work, of a coefficient stating how many units of work the performance of one item in it requires on the average. The use of such information in measuring the total volume of work in the office and in forecasting future work volumes helps in insuring that there is proper force provision and that if additional employees are required they will be on hand, adequately trained, when needed.

Office Arrangements

Experience demonstrates that environment has an important bearing upon the quality of the business-office job. Consequently, there have been quite a good many changes over the years in telephone company business offices. Where once customers stood at counters to transact their business, they now sit in comfort beside service representatives' desks, a convenience much appreciated by employees and customers. It makes for a better contact with a feeling on the part of the customer of greater privacy and more personal attention. The tone of service is further improved by providing attractive quarters, tastefully but not extravagantly appointed, with their general appearance in keeping with the community.

In the very large cities, the large volume of telephone contacts has made it necessary to establish "record" offices where only telephone contacts are handled. Here too, a quiet, well lighted, orderly, and attractively arranged office promotes pride in the job with benefits to good overtones, concentration, and accuracy.

Much of the office equipment, records, and reference material has been "tailor made" for the service representative, so she will have at her fingertips the information most frequently used during contacts. This helps to insure accuracy and avoid delays looking up information while the customer holds the line. A specially designed desk, for example, provides for seating service representatives in pairs with a "tub" file between them containing such records as their customers' service cards, collection data, and the toll tickets charged on the last one or two months' bills—since these are the toll charges customers are most likely to ask about. Service representatives are seated in pairs so that, should a service representative be busy when one of the customers in her group calls, the other representative may take the call and be able to consult that customer's records without leaving her position.

In the "tub" desk files each representative has at her fingertips the records most frequently used in contacts with customers

The Bell System concept of business-office service, with its translation into day-by-day operations, should explain why the Miss Smith who began our story, and her thousands of associates, find their work so interesting, stimulating, and appealing. It promotes pride of accomplishment and a state of mind which thinks in terms of an ever improving service. Customers' reactions to this approach to service are impressive. Their appreciation is evident from comments, volunteered or in response to special checks, and in many other ways—such as, the understanding shown in what could have been critical situations; and their response to the handling of small matters which employees could have treated as routine but which offer real opportunities to let customers know that the Company is interested in them and glad to be of service.

Without actually visiting an office and sharing with service representatives their experience during contacts, it is rather difficult to recapture fully the challenge and appeal in the best possible handling of customer contacts. As a substitute, it may serve to quote the words of another and anonymous service representative in concluding her discussion of her job during a recent survey:

"As a summary I would like to say that I am very happy in my work. My work is interesting, the people I work with and for are the very best, and our working conditions are very pleasant. There are very few companies where a woman can have a job where she is constantly with people that she would like to be with and where there is such a congenial atmosphere. Our work is varied to such an extent that it does not become tiresome. Every time you sit down at a desk you wonder just what is going to happen next and what unusual circumstances will arise. When a day is finished at the telephone company you leave work with a satisfied feeling that you've done a good day's work and that it was finished well."

When the American Telephone and Telegraph Company opened a stock transfer office in Chicago last Summer, the president of the Midwest Stock Exchange, Mr. James E. Day, was among those present at the occasion. The editor of the *Bell Telephone News* of the Illinois Bell Telephone Company thereupon invited Mr. Day to contribute a comment for publication, and the following paragraphs are quoted from his statement:

"The stockholder list of American Telephone is rapidly approaching the million mark. Such confidence is merited and earned. Good management and sound business policies have raised Telephone to the point where it is the largest public utility enterprise. Research facilities have been maintained to hold down costs through mechanization and increased efficiency as well as to develop new services for its customers. Here is free enterprise working for the public in two ways—promoting efficient communication service, and providing a fine investment medium.

"The company's growth has meant increased payrolls for more employees. Without its great record of expansion and earnings, there would be no means to provide the many privileges and benefits its workers now enjoy. This same growth pattern is beneficial to stockholders, as witnessed by dividend payments continued without interruption since 1881.

"This company represents one of the finest arguments for free enterprise in view of the fact that it is owned by the public and its employees and managed by men who have come up through the ranks. This management has been one of the first to recognize the value of investment bankers and brokers—not just for the purpose of raising additional working capital, but in its public relations with investors. They know and respect the fact that the broker is the man who meets their old, their new and prospective stockholders every day.

"Here is a great corporation operating under what we like to term the American Way of Life; i.e., privately owned rather than government owned. Compare this fine record with the results of nationalization of certain utilities abroad. We find in the latter not only the inability to develop products and service to compete in world markets but paying dividends to no one and providing a static record in employee benefits."

Industrial Statesmanship in London

President Truman's appointment of Mr. Walter S. Gifford, a Republican, as Ambassador to Britain has been justly hailed as a contribution toward strengthening bipartisanship in international affairs. But it is also recognition and utilization of the quality of industrial statesmanship which Mr. Gifford has exemplified during a long career.

Mr. Gifford has served the nation and New York City in many capacities. His survey of American industrial resources and his work with the Council of National Defense in World War I were successful pioneering ventures in a field whose tremendous importance is only now fully appreciated. He has given valuable assistance to such organizations as the American Red Cross, the Rockefeller Foundation and the Community Service Society. But his major preoccupation has been that huge and complex keystone of American communications, the American Telephone and Telegraph Company. President of A. T. & T. from 1925 to 1948, and then chairman of the board, Mr. Gifford has directed the growth of one of the largest and most efficient industrial networks in the world.

The talents necessary to hold such a post will be put to good use at the Court of St. James's. Because of its prestige, as well as of the organization of the United States foreign service, the London embassy is the heart of American diplomacy in Europe. It is good to know that the administration and inspiration of this delicate and essential operation will be intrusted to the tested skill and wisdom of Walter Gifford.

From the New York *Herald Tribune*

Telephone People Are Good Citizens, and the Bell System Puts Large Sums of Money into Circulation and Provides Stable Employment in Thousands of Communities

Business Is a Good Neighbor, Too

Kenneth P. Wood

EVERYBODY likes to have good neighbors: the family next door, friends down the street.

It is not boasting to say that telephone people are pretty good neighbors. They are the kind of people who feel responsible for the community in which they live and work. They engage in civic activities, and have a reputation for courtesy and friendliness.

Businesses, too, are neighbors. And for them, as with individuals, being a good neighbor is not solely a matter of being pleasant. Neighborliness is judged by how much a business—or a person—contributes to the general well-being of the community. The Bell System is very much aware of this fact, particularly with respect to furnishing telephone service that is high in quality and in usefulness.

Obviously, good telephone service is essential to the well-being of cities and towns throughout America. It is a necessity for business, vital in emergencies, and people everywhere rely on it for day-to-day personal and social use. In fact, life as we know it today would be practically impossible without the telephone.

This imposes on the Bell System a tremendous responsibility to make the service it provides as good as it possibly can. But beyond providing the best possible telephone service, there are many other ways in which the Bell System contributes to community prosperity—other ways in which it may qualify as a "good neighbor."

Large Sums Go to Communities

PERHAPS the most apparent of these, in its effect upon community welfare, is the money the System puts into circulation.

The operating payroll of the Bell System amounts to almost a billion

Attractive telephone buildings which harmonize with their surroundings are an expression of neighborliness and good citizenship

and a half dollars a year. This money, which is equal to about fifty percent of the System's total operating revenues, is paid regularly to people in thousands of communities, large and small, in every section of the country. The wages spent by telephone employees mean jobs and wages for people in thousands of other businesses.

The purchases of the Bell System Companies mean a lot of business for communities in every state in the Union.

The Western Electric Company, supply organization of the Bell System, alone bought from 23,000 different concerns in 2,500 cities and towns last year, and its purchases totaled more than three hundred million dollars.

The shopping list is practically endless, covering a great variety of products, from thumb tacks to motor trucks. Western's purchases during 1949 in Belleville, N. J.—to take just one typical community—amounting to about $375,000, included such items as paper, bags, files, rasps, felt, fabricated wood parts, fire extinguishers, chemicals, and precision instruments.

Other money from the Bell System goes into American communities in the form of dividends paid on stock of the American Telephone and Telegraph Company. There are 975,000 owners of this stock, and they live in cities, towns, and rural areas throughout the country. These investors come from all walks of life. They include farmers, business men, clerks, mechanics, clergymen, merchants, teachers, housewives, doctors, lawyers, civil service workers, people who have retired, widows—home-town folks and neighbors everywhere.

At least one in every fifty families has invested savings in A. T. & T. Many more have a beneficial interest through the holdings of insurance companies, schools, churches, hospitals, and charitable institutions.

Here is how Bell System disbursements are made in some representative communities:

Last year in Pawtucket, Rhode Island, the Western Electric Company made purchases totaling over $593,000 from 14 suppliers. These included such diverse products as webbing, wire, bolts, plastics, venetian-blind ladder tape, and cotton waste.

In addition to this sum, major expenses of the New England Telephone and Telegraph Company for payroll, taxes on property, and garage rental amounted to about $1,014,000. And there was an additional amount of roughly $120,000 in the form of dividends paid to Pawtucket owners of A. T. & T. stock.

For these purposes, then, Bell System Companies disbursed a total of more than $1,727,000 during 1949 in the city of Pawtucket, or an average of about $4.42 a month for each telephone in service there—a significant amount of money added to the economy of this one community.

Another representative community is Aurora, Illinois, where Bell System companies paid out more than $1,238,300 in 1949—an average of about $4.50 a month per telephone. The pattern was the same as in Pawtucket. Western spent $324,300 for purchases of a wide variety of articles from 15 different suppliers; the Illinois Bell Telephone Company paid out $861,000 in wages and other expenses, and A. T. & T. paid approximately $53,000 in dividends.

In some communities, the System pays out more money than it takes in. In Appleton, Wisconsin, for example, Western's purchases, disbursements of the Wisconsin Telephone Company, and dividends totaled over $1,912,000 last year, an average of about $10 a month per telephone, while $981,027 was received in revenues.

There are naturally many other miscellaneous expenditures that mean money for local businesses. As an example, Bell Companies spent over $10,000,000 in 1949 alone for tree trimming to prevent interference with telephone lines.

In addition, there are non-recurring construction expenses. From the end of the war through 1949, more than 3,800 buildings and building additions were constructed for Bell System companies at a total cost of $412,000,000. This, plus about $22,000,000 spent on alterations and repairs to existing buildings, added up to a lot of business for architects, real estate men, surveyors, contractors, suppliers of materials, and building craftsmen in all trades, right across the country.

Bell System taxes—and what they mean in the support of schools, fire and police departments, and other such public needs and governmental operations—constitute a sizable contribution to the American community. Local, State, and Federal taxes paid by the Bell Telephone Companies in 1949 totaled over $346,000,000. In the final analysis, of course, it was the telephone customer who paid this. He also paid Federal excise taxes amounting to about $445,000,000, collected for the Government by the Bell Companies.

Thus, taxes on Bell System telephone service in 1949 totaled nearly $800,000,000, equal to more than $2 a month for every telephone in service.

Stable Employment

COMMUNITIES where Bell Companies operate benefit, too, from the fact that Bell System employment is good employment. Telephone people receive good wages; they are covered by benefit and pension plans which tide them over in times of sickness and accident and provide for their retirement years. Here are some of the things these plans give to employees:

- Sickness benefits—up to a year's full pay, depending on length of service, to those unable to work because of sickness.
- Death benefits—up to a year's full pay, depending on length of service, to dependents.
- Pensions—every employee with 20 or more years of service can look forward to a pension of at least $100 a month at age 65, including Social Security. Many employees will get substantially more. For instance, a plant craftsman, now age 40, with ten years' service and a basic wage of $80 a week, can expect to retire at age 65, with 35 years' service, on a pension of $161.80 a month, including Social Security, based on his present wage and the existing Social Security law.

These things, plus the fact that telephone service is an essential, year-in-and-year-out business, mean stable and secure employment with a minimum of turnover. During the past five years, monthly turnover in the telephone industry averaged only 2.4 out of every 100 employees, compared to 5.6 per 100 in all manufacturing industries.

Telephone employment thus represents a factor of stability in the economy of the community; it contributes to the security of other businesses there.

Public Telephones

THERE ARE over 330,000 Bell System public telephones in service throughout the country, located in such places as cigar stores, restaurants, grocery stores, railroad stations, hotels, drug stores, and department stores. These businesses receive commission payments from Bell Companies for services performed in connection with the use made of public telephones installed on their premises. In addition, hotels are paid commissions on toll calls made from telephones in guest rooms. Nearly $30,000,000 was paid in commissions on public and hotel guest usage during 1949.

Beyond these commissions, public telephones help create business. A recent survey showed that one out of every five persons who went in drug, cigar, and stationery stores to use public telephones made purchases while in the stores, and that one out of of six companions who waited while the calls were made also bought something.

Independent Telephone Companies

FOUR-FIFTHS of the telephones in America are served by the Bell System. The rest are owned and operated by about 5,600 other telephone companies and by additional thousands of rural or farmer lines outside of the Bell System but connecting with it. Like the Bell Companies, these independent companies make important contributions to the communities in which they operate.

In addition to furnishing local telephone service, the independent companies perform the outstanding service of helping to make communications nation-wide. Their lines tie in with Bell lines to form the vast network which enables a telephone customer in any part of the country to call any other and to reach nearly 96 percent of the world's telephones. More than half a billion toll calls were handled by means of this arrangement in 1949.

The working together of Bell and non-Bell companies in this manner offers a fine example of coöperation between large and small businesses.

ALL THESE THINGS add up to an outstanding example of how business operates in America. They show how the success of one business contributes to the success of others.

Money taken in, in return for telephone service, goes back into the community in the form of telephone wages, expenditures for supplies, taxes, dividends, and service improvements. It is a continuing process, stimulating other businesses and making an important contribution to the over-all prosperity of communities throughout the country.

NOTE: This article also appears in *Public Utilities Fortnightly* for September 28. EDITOR.

School-to-Home Service, Involving Classroom Unit, School Amplifier, and Home Station, Brings Both Instruction and Companionship to "Shut-In" Youngsters

The Magic Box That Opens The Door to Education

Harold G. Weissenberger

ALL FAIRY TALES BEGIN with "once upon a time," and this one is no exception—although it is a fairy tale come true.

Once upon a time, then, when a youngster was unable to attend school because of physical limitations, it meant either no further schooling, or education only by a visiting teacher. These youngsters, confined to their homes, generally known as "shut-ins" or "home bound," might also be defined as "shut-outs," for they are generally shut out from society and a normal life. They have few friends, and spend day after day patiently trying to occupy their time between the relatively short visit of the bedside teacher and any other forms of amusement or occupation which might make the hours of the day pass more rapidly for them.

Now, with the offering of school-to-home service by the Bell System, many of these unfortunates have once again become part of a class, even though it be several miles away. The use of this service allows youngsters who had attended school at one time to "return," and those who have never been inside a school to "attend" for the first time. It brings them together with students their own age, even though only by voice, and creates a bond with society. It virtually opens the door to education—opens a door that had been previously closed. Their voices are the magic "Open Sesame" of the Arabian Nights, opening the door which contains the treasures of a more complete education. The voices of the teacher and of youngsters their own age bring the classroom into their homes. The transmission of their voices to the classroom through the magic box makes them a part of the class, just as if they were sitting in a seat beside other children. The opening of that door leads to riches which yesterday were not within their reach. These riches go beyond education, for they also bring companionship and an interest in life which without the magic of communications would not have been possible.

WHAT IS this school-to-home service, which opens such vast domains for the shut-in? How did it come about, and how does it work? What arrangements must be made for its installation? What does it mean to the handicapped, and how does it affect existing home instruction programs?

A considerable amount of work and experiment was necessary before the service was ready for use. The Bell Telephone Laboratories had undertaken before World War II the development of equipment for the service, and in the early stages of the war coöperated with several Bell System companies in the installation of specially assembled equipment. These trial installations indicated that the service could be provided, and that it was acceptable to educational authorities as a means for instructing the home-bound.

After the interval of the war, the Laboratories coöperated with Executone Incorporated, of New York, manufacturers of electronic communication systems, in adapting the design of their equipment for this type of service. The equipment, which uses patents owned and licensed by the American Telephone and Telegraph Company and the Western Electric Company, was modified to meet Bell System standards, and was tested by the Laboratories to assure that it could be used with telephone facilities. It is this equipment that is being used to furnish the service, making Executone another one of the more than 24,000 manufacturers who are supplying equipment or parts to the Bell System.

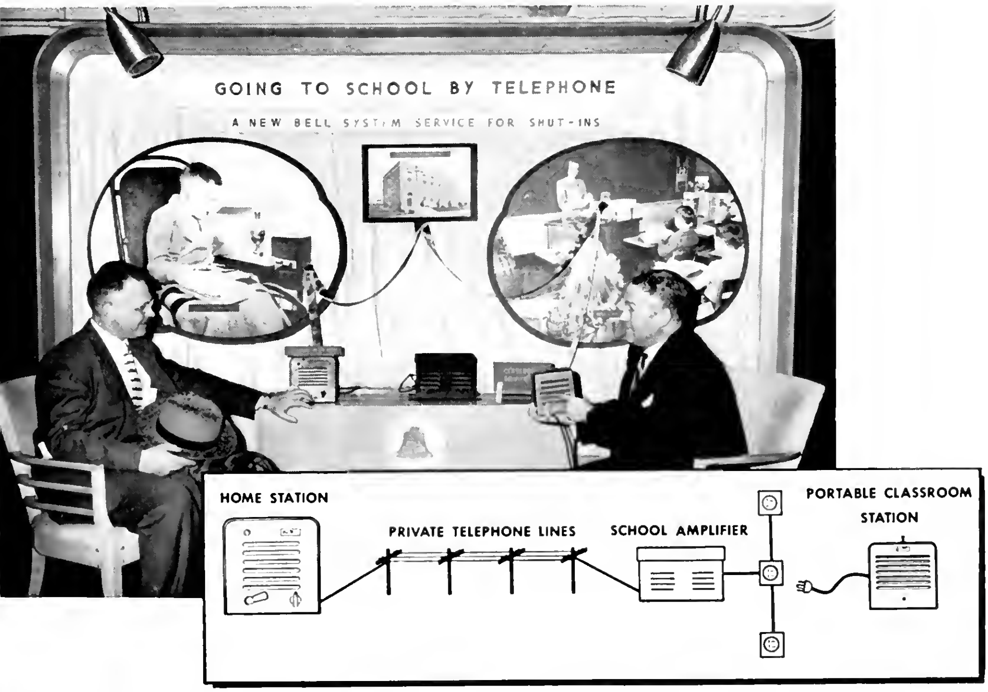
Basic Equipment

SCHOOL-TO-HOME service is basically a two-way speaker-microphone arrangement between the classroom and the home of the handicapped student. There are several arrangements of the equipment which are used; fundamentally, however, the operation of each is the same. All systems normally consist of three components: the portable classroom unit, the school amplifier, and the student's home station.

Usually the classroom unit is located in the vicinity of the teacher's desk, about five or six feet from the floor, with the face of the equipment toward the students. A wooden stand provided by the school, and perhaps made by one of the woodworking classes, has generally proven very satisfactory for the purpose. The unit, which weighs about five pounds, is rather small, being only about 7 inches wide, 7 inches high, and 4 inches deep, and is housed in a metal cabinet with a bronze metallic finish. It can be conveniently carried from classroom to classroom. This unit is connected to the school amplifier by wire, and does not require connection to a source of power in the classroom.

The school amplifier is contained in a brown wrinkle-finish metal box 7½ inches high, 9 inches wide, and 6½ inches deep, and weighs about 12 pounds. It can be mounted on a wall or shelf, and is usually located in a oom with other school equipment, ich as the custodian's room, the erk's room, or some other practical ocation where it is easily accessible the school people—since this unit as a switch which must be turned on the morning and turned off at the nd of the school day. This unit re- uires connection to a commercial ower outlet, and affords the link and ontrol between the classroom and e home station. It is connected to e telephone line in much the same anner as is a regular telephone. It perates over the same type of tele- hone wires that normally provide idividual-line exchange telephone ervice, going through the central of- ce or offices and finally to the home f the shut-in, where it is connected to the home station. The school-to-home service cannot be provided, unfortunately, in those areas where only party-line or rural-line service is available, since a private line is needed which is separate and distinct from the regular exchange service.

The home station, the magic box of the shut-in, which is now in use is about the size of a portable radio, and weighs about four pounds. A new unit, about the size of a small adding machine, will soon be made available, and will have a metal casing, similar to that of the classroom unit and weigh about 15 pounds. It should be located, whenever possible, on a desk, table, or shelf within arm's length of the student, so that he can easily reach the controls which ope-



This is how the Bell System's School-to-Home service was exhibited to educators at the hirty-seventh annual "Schoolmen's Week" held at the University of Pennsylvania in Philadelphia last Spring. The lower diagram shows the elements through which the service operates rate the equipment. The student makes the unit operative by turning on the power switch and adjusting the volume to the proper loudness, in the same way that a radio is adjusted for volume. Since the home station requires commercial power, there must be a wall outlet nearby.

Using the Magic Box

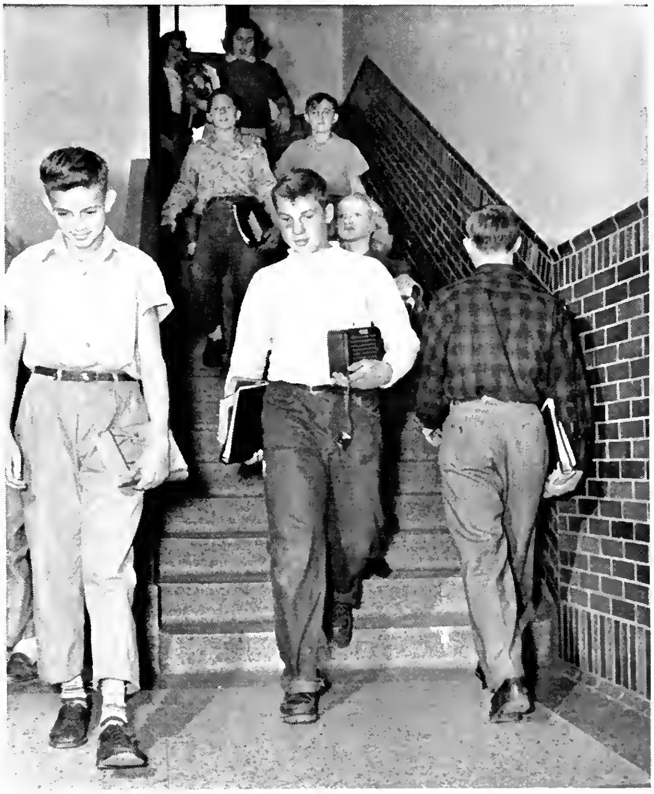
ONCE THE equipment is connected and turned on, the system normally picks up the classroom activity: the words of the teacher, the recitations of other students, the rustle of paper, and even the squeak of chalk on the blackboard. These sounds are received by the microphone of the classroom unit and are transmitted through the school amplifier to the private-line telephone channel, at a volume low enough to prevent interference with other telephone lines in the same cable. The sounds are then received and amplified at the home station, the amount of amplification depending on the adjustment of the volume control by the student. The amount of amplification is limited so that intelligible crosstalk (voices from other pairs of wires in the same cable) cannot be heard by the student when the volume control is turned to its top position.

When the teacher calls upon the shut-in to recite, or to answer a question, the latter changes the direction of transmission by pressing and holding the control switch to the *talk* position. This changes the home station from a speaker to a microphone and at the same time sends a signal over the telephone line which changes the classroom unit from microphone to speaker and conditions the school amplifier to amplify the student's voice through the classroom speaker. After reciting, the shut-in student releases the control switch on his home station and the service is automatically restored to its normal operation.

A member of the school staff turns on the amplifier at the beginning of the school day. In his hand is the classroom station

Another feature of

the service is that several shut-in students with their own individual home stations may attend the same class through the single classroom unit. This kind of service is somewhat similar to a telephone party line, since the shut-in students can hear one another as well as the teacher and the recitations from the classroom. However, if two students should press their control switches to the *talk* position at the same time, they would not be able to hear each other, because both would then have their microphones connected to the telephone line.



It is considered a special honor to be the pupil selected to carry the portable classroom station from class to class

It is interesting that, in most instances, where several students are connected to the same line, they talk to one another, compare notes and discuss lessons, even though the school equipment may be turned off, and thus gain an added companionship during the out-of-school hours and days. This is possible because each student's home station contains its own amplifier and the means whereby it may be changed from speaker to microphone.

As in all systems which use speaker-microphone equipment to pick up voices from a few feet away from the microphone up to 20 or more feet, as in a classroom, no one system can satisfactorily meet all the situations likely to be encountered. It is not to be expected, therefore, that remarks from all students in the classroom under all conditions will be picked up by the microphone and become audible to the shut-in. In those cases where there is some limitation to its use, it may be necessary for students who are farthest from the microphone to step up closer when they are called upon to recite, so that the shut-in can hear them.

Making Arrangements

To the customer, it may seem that, once the service is ordered, all that must be done is to obtain the equipment, connect it, and—as in any fairy tale—it is in operating order. There is still more work and planning, however, which must be done before the service is in operation, not only in making the actual installation but also in negotiating with the customer. Let us take a look, then, at some of the things which must be attended to before service is in operation in the home of the shut-in.

In general, there are a number of people whom it is desirable for the telephone representative to meet, in order to discuss the service and obtain information so that all parties involved have an understanding of the equipment, its advantages and limitations, and the problems that are most likely to arise. This is particularly true when it is the first installation for a school.

These people generally include members of the board of education and the supervising principal, the school principal, the class teacher, the bedside teacher, and the parents.

In discussing the service with them, it must be made clear that it can not be used by every handicapped youngster, and that it is not a panacea in the education of the shut-in.

Age must be considered. There are a few installations where the service is in use below the fourth grade, it is true; but in general it is most effective above this grade. This is primarily because of the large part that the visual senses play in education before the fourth grade, thus limiting the amount of knowledge which can be absorbed solely through the use of the auditory senses.

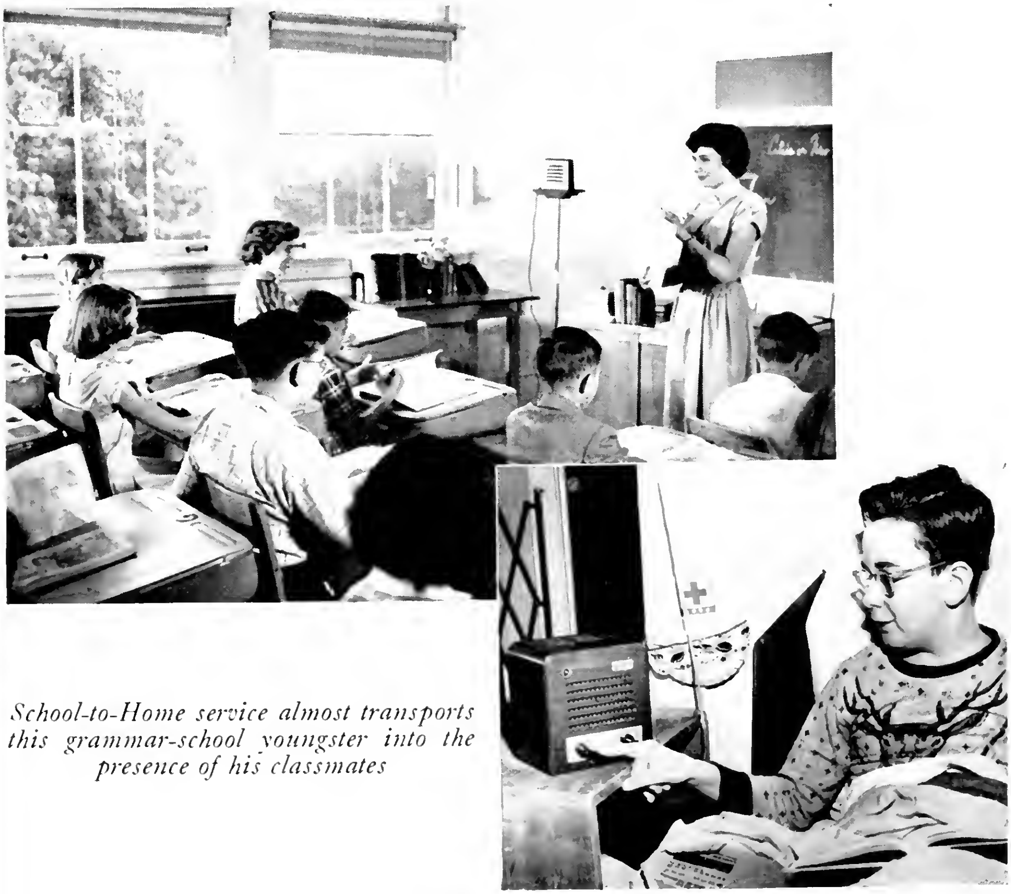
Another point for discussion is the need to review teaching techniques to be sure that the confined student does not get "lost" when the work involves visual presentation or other work not readily followed. This has been done so far without sacrificing too greatly the normal classroom procedure, but much work still remains to be done here as more experience is gained with the service. It would be not unreasonable to expect that the universities and teachers' colleges might include in their curricula, at some time in the not distant future, the use of this service and the techniques it requires.

Transmission and Reproduction

THE QUALITY of reproduction of the voice by the equipment must be explained, so that educators do not expect reception of radio broadcast quality from the equipment, which, after all, is designed only to give a good grade of service at a reasonable cost. The equipment, since it is not highly directional, picks up background noises from the classroom. These vary in intensity, depending on the size of the room, room acoustics, and other factors such as the type of schoolroom equipment, the number of children, their age, and the means of instruction. These sounds and noises appear to be greatly amplified when heard by the shut-in. Concentration by the student, and continued use, tend to minimize their interference, however, and they generally have little or no effect on the intelligibility of the words he hears and speaks.

The transmission of voices of small children offers another challenge to the use of the service. Their thin voices do not carry as well as the resonant tones of older students. However, somewhat the same conditions are present in the classroom itself, and usually the shut-in adjusts very readily and misses very little of the classroom work. Oftentimes a demonstration of the service by a telephone company representative helps immeasurably in bringing about an understanding of the capabilities of the service.

The representative of the telephone company and the school authorities usually visit the home of the shut-in to obtain the approval of the parents for the use of the service and to discuss its installation and operation. Many of the schools also survey the home at the same time, to make sure that the student will have suitable working arrangements and that there will be as little distraction as possible from other members of the household, radios, television sets, pets, and the like. These might be disturbing to the student and, moreover, result in the transmission of objectionable sounds to the classroom through the student's home station. It is also desirable to suggest that the parents consult their doctor to be sure that the youngster is physically and mentally able to become a "member of the class." Quite often students are only permitted to "attend" school on a part-time basis because



School-to-Home service almost transports this grammar-school youngster into the presence of his classmates

This stimulating instructor makes his classes seem real to the high-school boy shown on the opposite page

their doctors have felt that a complete program would be detrimental to their health.

After the planning has been completed and the service is in operation, it has been the general experience that it takes about two weeks for the teacher, the shut-in, and the class to accustom themselves to the use of the service. After this period, the novelty and the consciousness of the existence of the equipment no longer are a factor, all parties become relaxed, and class work continues almost as normallly as if the shut-in were present in the class.

What the Service Means to the Handicapped

Now LET'S TAKE a look at what it means to the handicapped when the door to education has been opened as if by magic words and the student is inside. What are the treasures he finds hidden that makes opening the door worth while? The only way to answer this, of course, is to get an appreciation of what the service has done and is doing for those who have used and are using it.

In an article in the October 1949 issue of *The Crippled Child,* official publication of the National Society for Crippled Children and Adults, Inc., Mr. W. A. WinterStein, Director of Special Education in the State of Iowa, one of the pioneers in providing this service and the man who has perhaps had more experience with it than any one in the country today, stated:

"Life will be different this year—at least for some of those children who are unable to attend school because of handicaps resulting from cerebral palsy, polio, arthritis, tuberculosis, or cardiac disorders, or from a disabling accident. At last, a way has been found to provide the handicapped child with some of the things he needs and misses the most—the opportunity to obtain a full education and participate in school work in almost normal fashion—the sense of belonging—the stimulus of social contact with his own age group—the pride of achievement.

"The mental and spiritual stimulation that instills the will to live and fight, and contributes so much to eventual recovery, is enhanced by the electronic school-to-home system which brings the shut-in child's classroom right to his bedside."

"Life is different" for those youngsters who are provided with the service. The words and laughter of fellow students are like magic to those who have never heard them before or who have been away from them for a long time. The girls and boys in the schoolroom quickly accept each unseen companion as one of them. They do not remain unseen for long, either, for curiosity concerning who is at the other end of the line soon prompts visits to the shut-in's home.

Recovering from polio, this lad keeps up with his studies while he awaits recovery to return to school

In a number of instances, the service has been provided to shut-in youngsters who have been regularly left alone, day after day, because both parents have had to be away at work. Even though they can get around enough to take care of their needs, even though a visiting teacher brings instruction several times a week, loneliness and boredom have been their steady diet. To such youngsters, the door opened by the magic box has made available a priceless treasure, and hours go by like minutes and days like hours. And they dread holidays and vacations as much as non-handicapped children look forward to them, for then their contacts with the outside world disappear, and they count the days until school opens once again.

Then there is another group to whom the school-to-home service is a boon and blessing: the temporarily handicapped, those who have suffered from some accident or sickness from which they will recover. Within six months, a year, two years, they will be back again with their schoolmates.

What does this service mean to these youngsters?

Without the service, a bond is broken. Schoolmates lose sight of Jimmy or Joan. In some cases, where home teaching is not provided, education stops. With the service, there is practically no interruption. They continue with their regular classwork, they hear familiar voices and remain a part of their classes, and they are not forgotten. When they return, it is almost as if they had never left. They continue with their own age group and take their place once again at a desk in the classroom.

These are but a few examples of what the service means to the handicapped. The advantages of "belonging" and being an active member of the class would justify its provision, even if little educational benefit were derived. Yet as an educational medium, the reports so far indicate, it has been extremely successful. In Iowa alone, approximately 1,000 children have received all or part of their education since this service was first adopted. Numerous cases are reported of students who, using the service, have led their classes in scholarship. Several have been valedictorians. When the disadvantages under which these students work are considered, this is a valid recommendation for it as an educational medium. These results seem to indicate that it may become a common and accepted form of instruction for shut-ins in the future.

Proof Positive

In telling this fairy tale, we have generalized so far. A review of some actual cases might indicate how valuable the students found the opening of the door to education to them:

Out in Wisconsin, just before Christmas in 1941, they picked Frank Huettner, Jr., out of an overturned bus on an icy road, and predicted he would never live. Frank had the will to live, and nearly a year and a half later, confined to a wheelchair, he began studying at home with the assistance of some of his teachers. He made up the 15 months that he had lost and was graduated in 1944. But how could he get his college education? Frank was anxious to attend teachers' college in Eau Claire. He heard of the experiments with the school-to-home service which were being undertaken at that time, and persuaded the college to permit the innovation. The Wisconsin Telephone Company provided a special assembly of equipment which in its operation resembles the equipment that is being offered today. For two years, Frank attended the college remotely and made straight A's during that time. In 1946, he transferred to the University of Wisconsin, taking his magic box with him, to study law. Frank's only surprise about all this is that any one should be surprised at the ability to get an education despite a handicap.

Roy Miles, of Merrick, N. Y., was a twelve-year old, whom rheumatic fever had forced to give up an active life in the early part of 1949 for one of lying in bed for months. Staying in bed, seeing very few friends, visited by his teacher only twice a week—Roy's spirits were mighty low. He thought he was the forgotten boy. Then the service was installed. Once again he was talking with friends whom he had neither seen nor heard for over three months. Roy recognized without fail almost every voice that came over his loudspeaker. With the service, Roy's marks improved, and his principal remarked that they were even better than when he attended school in person. His teacher also mentioned that "During my two visits a week, school work was difficult for Roy. He had everything at once. Now he can follow us in the class, and what he misses can be supplied when I visit him at home." Roy thinks the service is "swell."

The last story is about two youngsters in the same family, in East Baton Rouge, Louisiana. Fleming and Muriel Roe, a brother and sister, have been crippled since early childhood with osteomalacia (commonly called soft bones). Their parents heard of the school-to-home service, and requested the Southern Bell Telephone and Telegraph Company to furnish it. The service could not be provided by Southern Bell, because the home of the Roes was not in its territory. But that did not end the matter. It was recognized that the provision of the service called for ingenuity, coöperation, and work, so that these youngsters might for the first time "attend" school. On their own time, Southern Bell people in the various departments checked into the situation. The route was surveyed, and it was found that the school was about two miles from the home. The line layout was made and the costs were estimated. As the word spread through the "grapevine," others in the town offered assistance in the form of material, labor, and whatever other help was needed.

After the plans were made and the equipment obtained, 20 telephone workers, along with others in the town, contributed their day off and strung wires across poles already dug in by the children's father and other residents. By the following Monday, the children were "in school," members of the class for the first time. Are these youngsters enthusiastic about "going back to school"? This question does not have to be answered.

Home Instruction Programs

ONE QUESTION which frequently arises in connection with furnishing this service deserves a great deal of consideration. That is the effect of its use on home instruction programs. In furnishing the service, the Bell System does not contemplate that its use by schools should replace home instructors. Rather, it might be considered to be supplemental and a means for extending the scope of usefulness of home instructors, since fewer or shorter visits are necessary. In this way, they can serve more students or spend more time with those for whom the wire service is not applicable.

Writing on this subject, Mr. Lawrence J. Link, Executive Director of the National Society of Crippled Children and Adults, Inc., referred recently to a report, "Opportunities for the Preparation of Teachers of Exceptional Children," made jointly by the Society and the United States Office of Education, in which it was stated that "there are only about 20,000 special teachers in the country today who are qualified to work with handicapped children. More than 80,000 are needed to meet the needs of the nation's handicapped children. As a result, many thousands of children are being denied educational opportunities."

Mr. Harry D. Hicker, Chairman of the Commission for Special Education in Los Angeles, California, also recognized this problem, and in an article published in *California Schools* said that "the home instructor can spend as a maximum five hours per week with each student and as an average much less. Between visits there is either listlessness or uninspired self-study." In considering the use of the school-to-home service, he continued, "There are, of course, limitations in the use of the service. For instance, the plan would probably not be effective for a child not sufficiently mature mentally to visualize classroom procedure and to interpret instruction and discussion as heard over the teaching device."

This reiterates the facts brought out in the United States Office of Education report of the lack of sufficient teachers, as well as the fact that this service cannot be used in all situations. The reduction in visiting time to school-to-home service students will permit visiting teachers to give more time to children who cannot use the service and, in many cases, to instruct, for the first time, those children who have been unable to obtain such instruction because of the shortage of visiting teachers.

In the light of these two articles and the experience with the service so far, it might well be concluded that there is no danger of the service replacing or reducing any well-established program which may already be in use. Indeed, the availability of the service might even point out the need in many communities for a more extensive program of care for those

A Telephone Company representative shows a home-bound youngster how easy it is to operate the "magic box" which links him directly with studies and happy voices

whom we very often lose sight of, so that they may enjoy the same privileges as their more fortunate members in society.

Working with Educators

IN PROVIDING this service, the telephone companies of the Bell System are working with the boards of education, principals, and other school authorities in their communities to acquaint them with the service and to assist them in every way where there may be a need for this service.

Several of the Associated Companies have demonstrated and exhibited the service, by invitation, at conventions and meetings of large groups of people. These demonstrations were made not only to those whose interests are primarily in the educational field but also to organizations who are interested in the welfare and achievements of the physically disabled. An outstanding example of this is the demonstration and exhibit in November 1949 at the annual convention held in New York of the National Society for Crippled Children and Adults. As a special feature of the program, a crippled girl in a wheelchair on the stage of the auditorium took full part in a classroom discussion several miles away. This demonstration was given much publicity throughout the United States, and the school-to-home service received the endorsement of the Society as one of the projects which it plans to make available to children in states where educational programs for handicapped children have not developed because of lack of funds.

Not only has this service received widespread publicity in the United States, but radio listeners overseas have also heard the story of how communities in this country have not neglected the education of the shut-in. The "Voice of America" late last spring "attended" school with recording equipment and made transcriptions in both the classroom and the home of a shut-in. As the recordings were being made, classroom procedure was interrupted from time to time for explanation of what was happening. These explanations were translated into Austrian, French, English, Portuguese, and Italian, and broadcasts of the recordings were later "beamed" to listeners overseas to give them an idea "of the soul and heart that is America."

A motion picture is now under preparation by the Bell System which, in addition to showing other operations of the Bell System, will also show the operation and use of school-to-home service. This picture, called Screen Review No. 10, is being released this Fall, and will be shown in local theatres throughout the country, and also by the telephone companies to local groups who have an interest in this service.

As THE 1950–51 school year progresses, and as the public and educational authorities become aware of the usefulness of this service, it is expected that more and more children who have not been able to attend school will be depending on this service to bring them into the classroom once again. And as each new service is installed, this classroom fairy tale of the magic box that opens the door to education will be told over and over again.

OCTOBER MARKED a half century of serving the nation's long distance communications needs by the Long Lines Department of the American Telephone and Telegraph Company. Starting in 1900 with a few open wire lines which connected the principal cities of the east and midwest, Long Lines now operates over 20 million miles of circuits tying in with the facilities of 21 other Bell System companies and some 5,600 independent telephone companies to interconnect more than 40 million telephones throughout the United States. Fourteen million of the Department's 20 million miles of circuits are needed to handle a daily average of 850,000 long distance telephone messages. The other millions of miles of circuits are devoted to a variety of long distance services, including special private line telephone and teletypewriter, teletypewriter exchange service, telephotograph, and radio and television networks. The Long Distance Lines Department, as it was called until 1917, was set up by the A. T. and T. Company as a separate department with its own operating staff when it became apparent, at the turn of the century, that providing long distance circuits to interconnect local telephone companies was to be a large scale job. It now has about 23,000 employees in 366 communities in 40 states and the District of Columbia.

Western Electric Makes Equipment for Transmission of the Spoken Word; Teletype, Its Subsidiary, Makes Equipment For Transmission of the Written Word

Teletype's Share in Bell System Operations

Philip H. Miele

This is the seventh of a series of articles describing the Western Electric Company and its place in the Bell System organization. EDITOR

WORKING SIDE BY SIDE with Western Electric products in the Bell System's communication network, the Teletype Corporation's products keep almost 4,000,000 miles of circuits busy carrying TWX and private-wire messages. The extent to which industry is relying on teletypewriter communication for its day-to-day business dealings is revealed by the fact that Bell System subscribers to teletypewriter service are now using 55,000 printer stations.

Teletype equipment is manufactured by the Teletype Corporation, a subsidiary of Western Electric. Neighbor to Western Electric's great Hawthorne Works in Chicago, Teletype's plant employs some 1,800 persons, manufactures about 30,000 different parts for assembly in various items of printing telegraph apparatus which are used by a wide range of customers—the Bell System; other communications companies; Federal, state and local governments; transportation companies; and manufacturers, distributors, press services, brokerage houses and scores of others.

Extensive Line of Products

LET US very briefly examine how Teletype equipment works.

The simplest arrangement consists of two "Model 15" page printers connected by an electrical circuit. They both look like typewriters, having a keyboard and a set of type bars that print through an inked ribbon onto paper. When an operator types out a message, the message is printed on the paper of his own instrument and at the same time is printed on the paper of the other instrument. The operator at this other instrument can convert his printer from a receiver to a sender, then type out an answer.

Now, to introduce two more of

[T]eletype's products, let's add a tape [p]erforator and a transmitter-distrib[u]tor to the Model 15 printer—and [w]e have the Model 19 set. This set [m]ay be used for direct sending, as [d]escribed above, or for preparing [p]erforated tape for automatic trans[m]ission. The tape consists of a strip [o]f tough paper 11/16 of an inch wide [o]n which the message is recorded in [t]he form of many small holes or per[f]orations. This tape can be fed [t]hrough the transmitter-distributor, [w]hich will send the message automat[i]cally at maximum speed over the [w]ire to a teletypewriter or to still [a]nother unit of apparatus, the re[p]erforator.

The reperforator, as the name im[p]lies, reproduces the incoming mes[s]age by punching it on another tape [a]t an intermediate station for relay [t]o its destination. Some types of re[p]erforator also print the message [o]n this tape, so that it may easily be [r]ead. From the relay station's point [o]f view, the advantage of perforated [t]ape (in addition to speedier trans[m]ission) is that the attendant can re[l]ay the message automatically and [b]usy himself with other things while [i]t is being transmitted.

If we add several printers to the [s]ame circuit, another important prod[u]ct of the Teletype Corporation may [b]e introduced: the sequential selec[t]or, which permits automatic routing [o]f a message to one or several of the [p]rinters on the circuit. Before be[g]inning the message, the operator [t]ypes out a code "informing" the se[q]uential selector which printers he [w]ants to send to. The selector then [a]utomatically turns these machines [o]n, leaving the others temporarily [o]ff the circuit.

These are only a few of the basic items manufactured by the Teletype Corporation. There are many others, some of which combine in single sets different arrangements of the units already described, and others which perform entirely different functions in the field of automatic switching and multiplexing of circuits. Numerous accessories and attachments which make possible special applications of the products already described—a complete line of metal tables, consoles, and apparatus cabinets, designed specifically for printing telegraph use; parts of Automatic Message Accounting equipment; and Teletypesetter apparatus—round out the line of Teletype products.

A Model 19 printer. It is basically a Model 15 machine with perforator transmitter keyboard plus—to the left—a transmitter-distributor, which transmits the message from the punched tape, and—beneath the table—the tape reperforator, which records incoming messages by punching tape

There are many advantages of Teletype equipment as a medium of communication. One is that the written message is more permanent than the memory of a spoken message. Another is speed: with Teletype, you can send a written message across the nation or across the street in less time than it would normally take to type, address, and post a letter. One of the most engaging advantages of Teletype, however, is that it can be used on already existing telephone circuits (by converting them into 18 printing telegraph circuits each), making its service much more widely available than would otherwise be possible. This, in fact, is the principal reason why Teletype Corporation is a member of the Bell System today.

In the Teletype Corporation's research development department, a development engineer checks the performance of an Automatic Message Accounting ticket printer—manufactured by Teletype for Western Electric

History of Printing Telegraphy

THE HISTORY of printing telegraph an interesting one. In 1824, Stu geon of England learned that if a iron bar were surrounded by ins lated wire, the bar would becom magnetized as electricity was passe through the wires, and demagnetize when the current stopped. This di covery paved the way for Mors whose telegraph system and the coc which bears his name are still in wic use today. With the Morse tel graph system, the person who r ceives listens to a series of dot-dashe (which are the result of magnetizin and demagnetizing of part of the r ceiver), then translates these into th written word.

Another step came with the inver tion of a machine to "listen" to code and automaticall translate this code int writing—which is wha Teletype does today The first practical ap plication of printin telegraph is generall credited to R. E House, who in 184 set up a workable cir cuit between Nev York City and Phila delphia. Numerou improvements and re finements followed, in cluding the Hughe Printing Telegraph which was introducec about ten years later Another outstanding contribution was made by Jean Maurice Emile Baudot, an officer of the French Telegraph

Service, who in 1875–1877 developed a new system based on an entirely different code. The Baudot machine reads a code consisting of impulses of equal length, instead of short "dots" and long "dashes"—a simpler and speedier arrangement which is now widely employed in the printing telegraph field.

With this code, the time it takes for one letter or character to be sent and received is divided into five periods. The circuit can be either open or closed during each of these five time-periods. Each of the alphabet's letters requires a different sequence in which the circuit must be open and closed; the receiving machine reads the sequence and translates it back into whichever letter was sent. (Today's Teletype apparatus normally does this at a rate of from 60 to 75 words a minute.)

Baudot's code requires that the receiving machine be synchronized with the sending machine. Following his invention, a great deal of developmental work was undertaken to provide simpler and more dependable synchronizing methods. The Morkrum Company, early predecessor of Teletype Corporation, produced a solution in the form of a start-stop method of synchronizing which, with refinements, is still in use today. This company was started in 1906 by Charles Krum, who provided the technical "know-how," and Joy Morton, founder of the Morton Salt Company ("when it rains it pours") who backed the enterprise financially. Sons of these two men, Howard L. Krum and Sterling Morton, took over the active management of the company about a decade later. This company manufactured the machines which were used first by the Postal Telegraph in 1910, then by Western Union in 1911, and (revolutionizing newspaper business) by the Associated Press in 1915.

Meanwhile, the Kleinschmidt Electric Company in Long Island was also manufacturing telegraph printers. Both companies engaged in spirited competition for a market, which then consisted of only a handful of customers—some railroads, press services, and the Postal and Western Union

In the drawing-board stage of Teletype's design department are piece-parts which will take their place in new and better equipment for transmission of the written word

Telegraph Companies. Mainly for economic reasons, the two companies merged in 1925, forming the Morkrum-Kleinschmidt Corporation, with the Morkrum plant in Chicago as headquarters. A few years later, the name of one of its products was adopted as the firm's name and the Morkrum-Kleinschmidt Corporation became the Teletype Corporation.

Bell System Affiliation Broadened Services

TELETYPEWRITER EQUIPMENT can work on telephone circuits—as was mentioned earlier. The Bell System, in the early days, leased wires to numerous subscribers who used them for teletypewriter communication. The demand for this service was growing and the Bell System became Teletype's major customer. But even with this growing demand, the use of Teletype's equipment was restricted to those few large companies with communications needs sufficiently large to warrant their owning circuits or leasing them.

It was apparent at that time, first, that teletypewriter service was no longer incidental to the telephone business, but was destined to become an important adjunct to it; and, second, that if Teletype communications were to be made generally available to smaller business firms and individual users at lower cost, basic developments were necessary. It was felt, therefore, that if the Teletype Corporation were part of the Bell System, the printing-telegraph-using public would benefit just as the telephone-using public benefits from Western Electric being part of the System, because in that way the three essentials of service—research, supply, and operation—would be coordinated to produce better service.

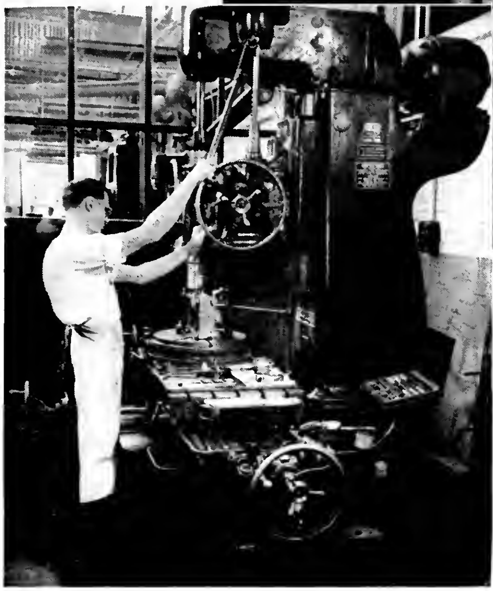
Teletype Corporation became a full member of the Bell System in 1930, as a Western Electric subsidiary, and less than a year later a new development took place that was as important, in its way, as was the invention of Baudot more than a half century earlier. A switchboard for teletypewriters was developed, and in 1932 the Bell System announced a new service to the public: Teletypewriter Exchange Service (TWX), which used telephone circuits to provide nationwide printing telegraph communication. The switchboard permitted any TWX set in the Bell System throughout the country to be connected with any other, just as any telephone can be connected with another.

TWX Provides Nationwide Communications

THIS TWX SYSTEM put Teletype service within the reach of the thousands of smaller business customers whose need for speedy written communications did not warrant the expense of building their own circuits, or of leasing them on a part- or full-time basis. With the introduction of TWX, they were able to subscribe to this service just as most of us subscribe to telephone service, paying only for the length of time the line is used and the distance between the calling and the called parties.

This service not only made more firm the connection between Teletype equipment and the telephone network, but also opened up a vast new field for further development, with

Delicate saws and files (right) and towering jig borers are all part of the job of making the tools with which to make Teletype equipment



the result that printers can now be used over other kinds of circuits, such as microwave radio relay, mobile radio, and coaxial cable; and—also in parallel with the telephone industry—printed messages can be routed by automatic switching equipment.

Continuous Development Program

TODAY, development work is one of Teletype's major undertakings, closely integrated with its manufacturing activities. In its main building in Chicago are extensive laboratories for basic research, still others for developing and testing new products, and a complete model shop which is almost a miniature manufacturing plant itself. In fact, so important is development work that one out of every 20 employees is directly engaged in some aspect of product improvement. These employees are now working on a new line of printed communications equipment which will be fundamentally different from present Teletype products. In general, the goals of Teletype's research team are to increase speed of operation; to cut maintenance costs; to increase the flexibility of application; to reduce size, weight and noise; and to improve appearance.

All of these aims must be pursued within a framework of numerous invariables. A new printer, for instance, must be able to work side-by-side with equipment of earlier design that is already in use, and some specialized equipment must meet very rigid operating requirements such as would be found, for example, in an airplane installation.

Although Teletype, unlike other Bell System companies, looks to its own facilities for research and development, it nevertheless maintains an intimate working relationship with the Bell Telephone Laboratories. The Laboratories design the networks on which Teletype equipment is used in the Bell System, specify traffic and operating requirements, and translate Bell System needs into research and development projects to be undertaken by Teletype's staff. In short, it is a customer's specific need that is the mother of invention at Teletype.

DURING World War II, when the Government was the Company's principal customer, more than 100 major development projects were carried to completion. Right after the war, an interesting one was undertaken for the Civil Aeronautics Administration, which employed 600 weathermen in widely scattered stations. These men typed hourly weather reports to a central headquarters, each waiting his turn to use the circuit. The problem was to save the time that the 600 men spent in waiting their turn. Teletype developed a device known as the SECO (SEquential COntrol) which permitted each man to punch his report out on a tape, then put the tape in a transmitter and go about his other duties. Meanwhile, the SECO at the central receiving machine automatically turned the transmitters on in their proper rotation, thus picking up the messages that had earlier been punched on the tapes. If one man's tape wasn't ready, the SECO would wait two seconds, then go on automatically to pick up the report from the next station. The SECO, incidentally, was soon after tailored to meet special Bell System needs and is known as the SOTUS (Sequentially Operated Teletypewriter Universal Selector) used in 81-Type automatic telegraph switching systems.

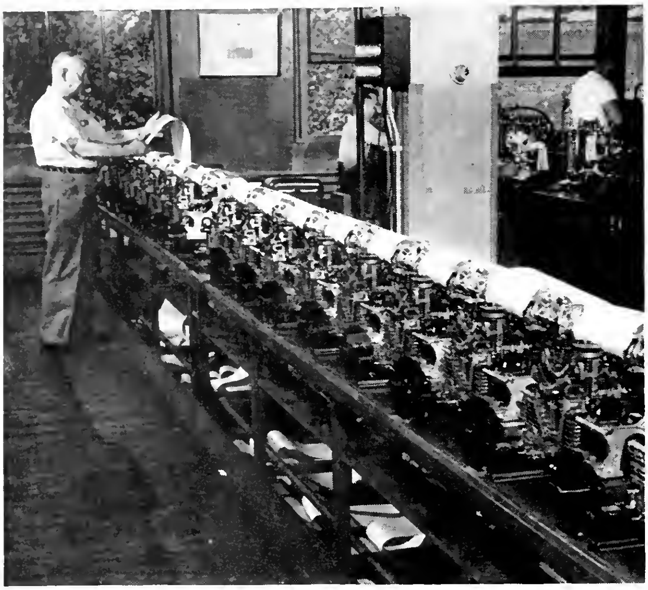
Complete Manufacturing Facilities

TELETYPE's emphasis on the specific needs of its customers in its research and development work is equally apparent in its manufacturing activities. In the manufacture of its products, the basic mass production techniques of standardization, precision, interchangeability, and highly specialized processes are carefully blended with the "tailoring" of an extremely wide variety of end products to serve individual customers' needs. For instance, the typing unit of the Model 15 Printer (known by Teletype people as their "bread and butter" product), may be assembled to embody about 150 different combinations of features and accessories that customers may require. And the typing unit is only one of several units that comprise the Model 15 Printer.

A visit to Teletype's plants is strikingly similar to a visit to any of Western Electric's manufacturing locations. You'll see punch presses at work and men using delicate gauges and instruments for measuring to within .0001 of an inch (on punch blocks for tape perforators); benchrows of employees doing delicate wiring and assembly operations, and rooms in which draftsmen sit at drawing boards designing tools and products. There is a heat-treating area where piece-parts and tools are hardened in cyanide or in salt baths at temperatures up to 1600°F., and where tiny piece-parts are relieved of inner strains in electric furnaces. Most of Teletype's heavy manufacturing operations take place in the main plant on Wrightwood Avenue. These include tool-making, heat-treating, and piece-part manufacture. Light operations, assembly, final testing, and packing are performed at the smaller rented Fullerton Avenue plant.

Throughout the long chain of manufacturing processes that convert raw materials into a finished product, there are inspection operations each step of the way to insure high quality. Some of these are sample checks, following the Bell System pattern of statistical quality control, the basis of which is scientific sampling; others are complete inspections. On the Model 15 printer, by the time its 3800 parts have been made and assembled, some 7500 different inspections have been performed. Then comes the final test, with rows of newly assembled printers typing test messages, their bells ringing and sounding very much like the telegraph printer room of a large newspaper. This test covers 10,000 words of printing, after which the printers are readjusted when necessary; then another test of 5,000 words which every printer must pass with flying colors before it can be shipped to a customer.

On the last lap of the assembly line, typing units for Teletype's Model 15 printer—the Company's bread-and-butter item—receive a final adjustment



When the Model 15 Teletype printer's 3800 parts have been made and assembled, and some 7500 inspection operations have been performed, the final steps include a 10,000-word test, any necessary readjustment, and a final 5000-word test

Important Field of Communications

THE TELETYPE CORPORATION has numerous customers. The major portion of its products are supplied to various communications companies and, currently, the U.S. Government. The Bell System, Western Union, international telegraph companies, press wire services, and others in like fields combine Teletype machines with their extensive communications facilities and, in turn, offer complete and modern services on a leased or message basis to their many subscribers and customers.

The U.S. Government, in addition to utilizing these services of the communications companies, buys many Teletype machines outright for connection to Government-owned or Government-leased circuits. Military networks, thus arranged, encircle the globe, while several nationwide Civil Aeronautics Administration networks control movement of domestic aircraft and keep them supplied with up-to-the-minute weather information.

Numerous other customers serve their own communications needs by purchasing Teletype machines directly for use on their own wire facilities. Railroads are typical of this customer group.

Domestic sales of Teletype's apparatus are handled directly by Teletype's staff. Exception is made in the case of sales to State, County, and Municipal departments, which are handled by Graybar Electric. Canadian and foreign sales of Teletype's products are handled through distributors serving the written communications field. Users served on a leased or message basis look to the respective communications companies for fulfillment of their needs. Teletype's sales activities include dissemination of information regarding the various products and their uses, and providing technical aid to customers and distributors in helping them select equipment most suitable for their specific needs.

Related services to customers include school training of their personnel on the maintenance of Teletype's equipment. In the classrooms of this school, located at the factory in Chicago, you may find students from the Army, Navy, railroads, Civil Aeronautics Administration, and other customers from all over the world. These class groups frequently include employees of Western Electric's distributing organization. (Much of the Bell System's Teletype equipment is prepared for installation and periodically overhauled in the shops of Western Electric's distributing houses.)

Related Product Employed by Publishers

TELETYPE HEADQUARTERS at Chicago is also the headquarters of its subsidiary, Teletypesetter Corporation, which has merchandised Teletypesetter equipment since 1932. This equipment (which utilizes the basic selection features employed in the present Teletype printer) is used in the printing and publishing field for the automatic operation of linecasting machines. Code combinations denoting the proper letters, characters, and composing-machine functions are first recorded in perforated tape. The tape is then fed into a Teletypesetter operating unit which activates the linecasting machine. With this equipment, a national magazine can have all its editorial offices in one location and, by means of wire transmission of the tape copy, go to press simultaneously in any number of distant cities.

The principal elements of a Teletypesetter system are the perforator, which has a keyboard very much like a typewriter, on which is punched the tape copy; and the operating unit, which is mounted on the linecasting machine and which automatically translates the tape perforations into the mechanical functions essential to the typesetting operation. Transmission of the tape copy from editorial room to composing room in either local or distant operation is accomplished through use of specially designed Teletype 6-unit code transmitting and receiving apparatus.

Firm Has Achieved Wide Recognition

INDUSTRIES which use Teletype's products depend on them heavily. The speed with which news is disseminated by the great press services is made possible by Teletype equipment. Railroads use this equipment to keep track of freight and car movements. Many manufacturing industries use Teletype equipment to communicate from one plant to another, even from one office to another within a plant. Western Electric, incidentally, has a large installation of this type, and so, appropriately enough, has the Teletype Corporation. These are private line users. As for TWX subscribers, there are over 26,000 subscriber stations, serving almost every activity that makes up the American economy.

The nation as a whole also depends heavily on Teletype's products in the day-to-day operation of its government and armed forces. State and local police flash descriptions of wanted criminals throughout the country, weathermen of the C.A.A. send up-to-the-minute reports in to headquarters from their far-flung posts, and other government agencies use Teletype just as extensively as industries do. The Teletype Corporation, with its two manufacturing plants in Chicago and its 1,800 employees, plays a role in the nation's communications far out of proportion to its modest size.

This, to a great extent, is a tribute to the management and employees of the two early companies of which the Teletype Corporation was formed. It is no less a tribute to those of today who energetically carry on Teletype's tradition of building newer and better machines for printed communications, and to the Bell System environment in which Teletype employees have lived since 1930—an environment in which are intimately coöordinated the functions of research, supply, and operation.

It's one o'clock in the morning. You're on your way home alone, and your footsteps echo flatly on the pavement.

The street spreads away before you, empty and silent. The wind scuffs up a paper behind you, and you jump a little.

Then you laugh at yourself, and as the vacant, darkened windows of the buildings on either side gape down at you, you think, "Boy, this town is *really* asleep—not a creature stirring—not even a mouse. . . .

"But wait a minute! There's a light in that building over there. Wonder who's up? Maybe somebody forgot to turn it out."

And then it comes to you. That's the telephone building. No one forgot to turn out that light. It never goes out the whole night long. And as you walk on down the street, you think about it.

You think about what that light means. About wires and cables and switchboards. But more than those, you think about the people who are ready at all times to speed the messages through—to serve their community and their nation. What does it all add up to, you ask yourself? *Security.* Your footsteps beat out the word. *Safety,* they tap. *Preparedness,* they echo.

"Other lights go on and off," you say to yourself. But that light keeps on burning. And as other lights burn longer too, these days, in factories and shops working on vital production needs, you realize that telephone men and women in this town and towns everywhere are working with them around the clock—providing a service that can be depended on to unite the people in their common aims, to get things done quicker, to play its full part in any task to which America sets its hand.

Telephone Story heard on the "Telephone Hour" radio program

Twenty-five Years Ago in the

Bell Telephone Quarterly

Items from Volume IV, Number 4, October 1925

The Bell System Coöper-ates in Defense Tests

ON JULY 4, 1925, the Bell System participated in the exercises of Defense Test Day by placing at the disposal of the military authorities a considerable portion of its long distance telephone facilities.

Its contribution to the communication features of the program included the linking of Washington, New York and Chicago by long distance telephone lines for two-way conversation, making possible addresses at all three points.

The program was opened at 9:00 P.M. by Major General Charles McK. Saltzman, Chief Signal Officer of the Army, presiding at the office of the Secretary of War at Washington. A report covering the military mobilization carried on as part of the test in the eastern part of the country was made by General Charles P. Summerall, Commander of the Second Army Corps Area, at New York, and a similar report, covering the western part of the country, was given by Major-General Harry C. Hale, Commander of the Sixth Corps Area at Chicago.

Addresses were delivered from Washington by General John J. Pershing and Major-General John L. Hines, Chief of Staff; from Chicago by Vice-President Charles G. Dawes; and from New York by Acting Secretary of War Dwight F. Davis, and Walter S. Gifford, President of the American Telephone and Telegraph Company.

Twenty-eight broadcasting stations were connected with the circuit and made the entire program available in all parts of the country. This was the largest number of stations ever connected for simultaneous broadcasting.

To demonstrate the usefulness of the process of sending pictures by wire, developed by Bell System engineers, two telephotographs were transmitted from San Francisco to New York for development and delivery at Washington. One of these, a map of the line of march from the Presidio to the civic center, San Francisco, was of particular interest to military authorities as illustrating the value of the telephotograph system in transmitting maps, drawings and other data in an emergency.

From "Notes on Recent Occurrences"

More Dependable Service by Cable

THE NEW YORK-CHICAGO CABLE means protected, stabilized service.

Leaving Manhattan by way of the Hudson tunnels, the new cable strikes westward across New Jersey, Pennsylvania, Ohio, Indiana, an eastern corner of Illinois.

Under rivers and cities it runs, over hills and mountains, through pastures and orchards, leaping ravines and quarries, following highways here and abruptly taking to forests there, hugging railroads for a time and then spurning lower levels to fling its giant silvery thread across the top of a rock-strewn ridge.

The man who would follow this almost unique line must be ready to ride an airplane; and even so, he must be prepared to report that he missed nearly a hundred and fifty miles of its length, since that much of it is snugly under ground.

What does it mean to the telephone man, this great new cable link, this long stride forward in the furnishing of the nation's long distance service?

First of all, it means that another of his larger visions has come true. In this case, as in every other major project of the System, it means that problems of the first importance have been solved. Nearly a decade ago the general plans were made. Then came the careful consideration and decisions of executives; then the underlying work of engineers, inventors and scientists; then the skilled efforts of designers, manufacturers, installation and construction forces; and finally the maintenance and operation of this new link in the System by the trained people whose responsibility it is to keep it continuously working at full efficiency in the service of the public.

From an article by T. T. Cook, then Assistant to the Director of the Long Lines Department

The Bell System

THE OBJECTIVES or the ideals of the Bell System may be considered to be fourfold in character. First, to give to the people of the United States the best and most comprehensive and satisfying telephone service which can be given to them.

Second, to bring out in each of the 350,000 workers in the Bell System the best that is in him or her so that that best will be devoted to the problem of giving telephone service to these United States.

Third, to make a fair return to the more than half million people who have provided the money necessary to build the telephone plant which is essential to the rendering of the service.

Fourth, to continuously develop the art. We cannot rest satisfied with applying the telephone art as it is from time to time or as others may create it. On account of the large proportion that we are of the total industry in the United States and in the world, the obligation rests in us to develop the art in every possible way.

Those four objectives or ideals are not inconsistent with each other; in fact, when properly regarded they are in entire harmony. It is sometimes thought that there is some inconsistency between treating the owners of the property fairly and making money for them on the one hand and rendering the best and most satisfying service on the other hand. Such, however, is not the case. It is not possible for a poor and ill-nourished institution of any kind to render the best service. It is not possible for an institution, the employees or workers of which are dissatisfied, to render the best service. On the other hand, it is impossible in the long run for a concern which does not render good service and improve its service intensively as opportunities offer either to make its workers happy or to make money for its owners.

From an address by Bancroft Gherardi, then Vice President of the A. T. & T. Company

Who's Who & What's What

(*Continued from page 135*)

occasionally, things like stories on the dual relationship of Teletype Corporation as a Western Electric subsidiary and teletypewriter service as a Bell System function. His article on "Giving New Life to Old Equipment" appeared in these pages just a year ago. His present contribution completed, he left the Bell System this fall to pursue further studies abroad.

Number Four · Winter 1950-51

B+T

Bell Telephone MAGAZINE

American Telephone & Telegraph Company · New York

Bell Telephone Magazine

Winter 1950-51

A Medium of Suggestion & a Record of Progress

Published for the supervisory forces of the Bell System by the Information Department of American Telephone and Telegraph Co., *195 Broadway, New York 7, N. Y.*
Leroy A. Wilson, *President;* Carroll O. Bickelhaupt, *Sec.;* Donald R. Belcher. *Treas.*

Who's Who & What's What
in This Issue

When Bartlett T. Miller gave the address which is printed on page 197 & ff., on October 11, 1950, he was a vice president of the American Telephone and Telegraph Company, with staff responsibilities. Since November 3, he has been vice president in charge of Public Relations—retaining at the same time some of his previous duties. His telephone career began in 1910, when he joined the Colorado Telephone Company. Traffic and Commercial work in the west and with the New England Telephone and Telegraph Company preceded his successive appointments with the latter Company as vice president, Public Relations; vice president, Public Relations and Personnel; and vice president and general manager. The last-named position he relinquished in 1946 to become an assistant vice president in the Department of Operation and Engineering at A. T. & T. A year later he became vice president in charge of the Long Lines Department, and he returned to A. T. & T. Headquarters early in 1949. To this Magazine for Winter 1948–49 he contributed "The International Telecommunication Conference of 1947."

A career in the Bell System began for Richard D. Campbell when he went to work for the Chesapeake and Potomac Telephone Company in 1922 as a student engineer. Eight years of foreign wire relations work followed, until his transfer to the A. T. & T. Company in 1930. There he has worked on radio engineering problems in the Department of Development and Research, Operation C Department, and the O. & E. Department. Responsibility for frequency assignments for telephone company radio systems was a major part of this activity, and in this capacity he has served as a Bell System representative on United States delegations to four international radio conferences. Recently he has been in charge of a group working on engineering problems in connection with the Bell System's use of radio for point-to-point service.


Bartlett T. Miller


Richard D. Campbell


Earl Schooley

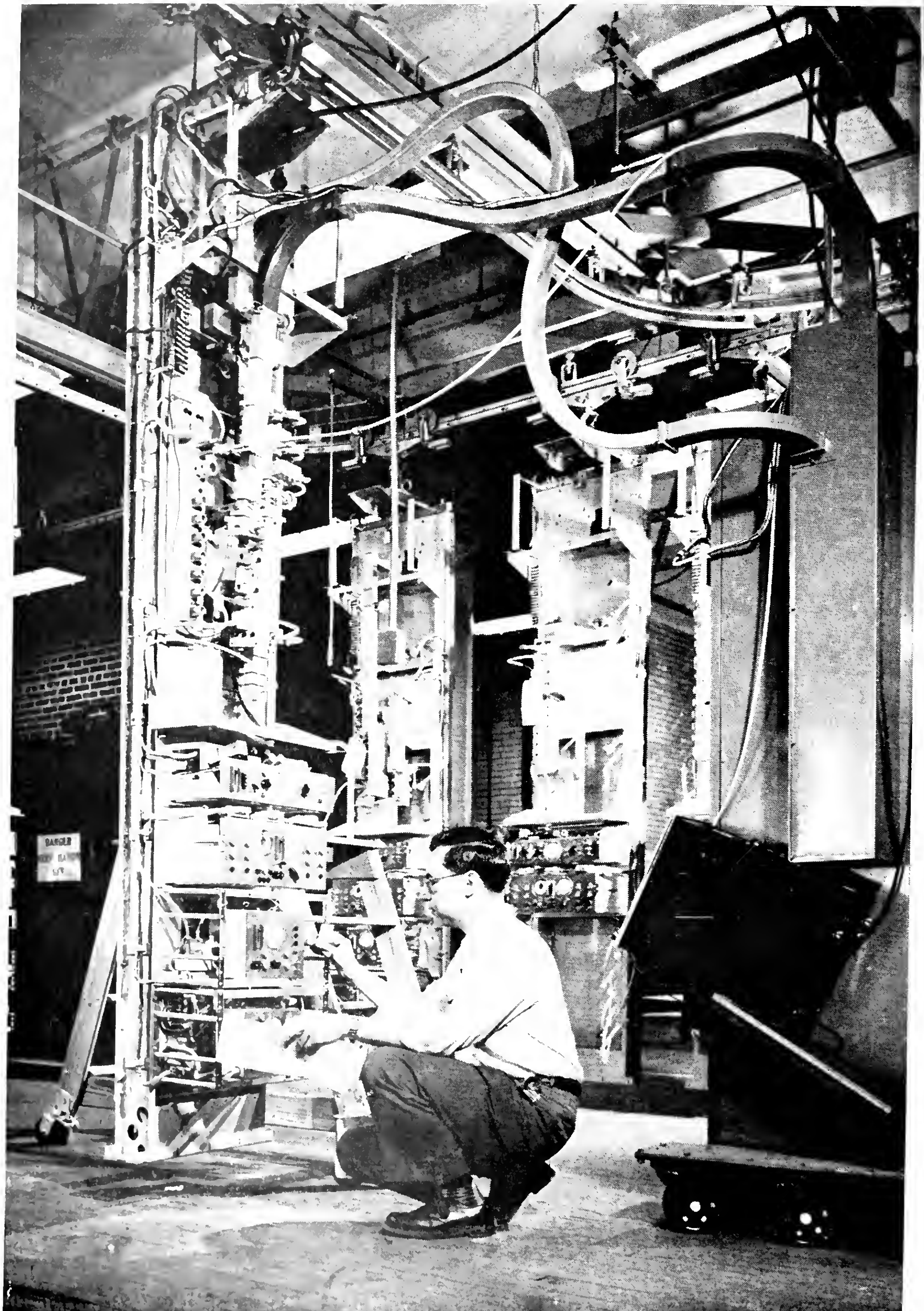
Walter V. Brown *Judson S. Bradley* *Elizabeth Wrenshall*

Earl Schooley's first telephone job was with the Bolivar (Mo.) Telephone Company. There he was a combination of night operator, lineman, installer, troubleshooter—and motion picture operator in the local movie house, which was owned by the telephone manager. In 1927 he joined the Long Lines Department in St. Louis as a student, and two years later became a technical employee in the division office there. A transfer to Kansas City and a return to St. Louis preceded his assignment to the Engineering Department in New York. Here he worked on carrier systems and in 1944 was appointed coaxial cable carrier engineer and in 1946 was appointed carrier and electrical coördination engineer. He went to Washington, D. C., in 1948, as division plant engineer, and returned to New York after a year and a half as facilities engineer. He became engineer of transmission in February 1950, and last December was transferred to the Commercial Department of Long Lines to assume the new post of commercial development engineer.

If a slight spicing of showmanship is detected in the activities which Walter V. Brown describes in this issue, it is because that contributes to the element of entertainment which is essential in conveying useful telephone information to customers during eleven million face-to-face contacts in the course of a year. Mr. Brown's telephone career began with the Southern New England Telephone Company in New Haven in 1927. After a few years in the Engineering and Commercial Departments he changed over to the General Information Department, where he was information supervisor until 1943. In that year he transferred to the Information Department of the A. T. & T. Company as public relations supervisor. Three years later he was made public relations manager, and since April of 1950 he has been public film and display manager.

The present article is Judson S. Bradley's fifth description in these pages since 1936 of storm damage and telephone reconstruction, its most recent predecessor being "The Winter's Toll Was Heavy from Texas to the Dakotas," which appeared in the issue for Spring 1949. Joining the Information Department of the Southern New England Telephone Company in

(*Continued on page 270*)



Testing microwave radio transmitter-receiver equipment in a plant of the Western Electric Company. Wave-guide "plumbing" is used to make the connection with the test equipment at the right. *See "Spanning the Continent by Radio Relay," beginning on page 215*

A Talk before the U. S. Independent Telephone Association On Mutual Problems, Responsibilities, and Opportunities Of the American Telephone Industry

Telephone Communication In a New Era

Bartlett T. Miller

ONE THING that distinguishes telephone people is that all of us have the same objective of giving the best possible service to everyone who wants it. We have known for a long time that the way to do that—and the only way—is by working together. Your invitation to me to take part in this Convention is further evidence of how you feel about it, and I assure you I am here in the same spirit.

Of course, the test of our work is in the progress we make and the results we obtain. And it seems to me that never in the long and resultful history of this industry has there been a finer accomplishment than during these last few years. I am not saying this as a representative of the Bell System, or as a member of any particular organization within the industry, but rather as a telephone man who feels a tremendous pride in what the entire group of telephone men and women have jointly brought about. Certainly it is one of the great industrial achievements of our time.

Five years ago we found ourselves with a mountain of held orders that had piled up because telephone production facilities had gone to war. We were also to find very quickly that a new peace-time army of people wanted telephones who had not wanted or been able to afford them before. More families wanted and were getting new housing through the biggest housing program ever undertaken. And for almost every new home, as well as for millions of older ones, the comfort and convenience and security afforded by the telephone were also desired. Then too, the people of this country have been moving on a vast scale; we have been seeing the shifting of great groups of our population from one location or area to another. As people have moved, we have moved with them—connecting and disconnecting and then connecting again—so that the volume of work in this respect alone has far exceeded all previous experience.

Today, our industry is serving some 42 million telephones, or 15 million more than at the end of the war. That is an astounding increase. And equally impressive, I think, although less well known, is the fact that to obtain this net gain, we have had to connect about 40 million telephone instruments in the last five years—almost as many as the total number now in service.

What the Figures Show

Those are big figures. But their greatest significance, it seems to me, is not in what they tell of the past, but in what they suggest for the future. The fact of prime importance is that we are now providing, and the country is using, telephone service on a tremendously expanded scale. The average man is looking at the service we have to offer and judging it under new standards of value, and he likes what he sees. It is good service, and fast, and convenient to use. It is courteous and friendly service. It is dependable service that can be relied on night and day. Those are not new characteristics, to be sure—but the sheer abundance of excellent telephone service today has made all these fine qualities more evident to more people.

Furthermore, the telephone has become more and more necessary as people live at greater distances from other people they want to talk to. And, in our present-day economy, it is cheaper than at any time in the past. Telephone service has always been an outstanding value—the one service in the home, for example, that people can have for a modest monthly charge without having to incur any investment of their own as they do when they buy ranges and refrigerators and washing machines, and all the other things they must have in order to use gas or electrical service. Today this telephone value is bigger than ever before. The average customer pays less for it, in relation to his income, than he used to, and he gets more for what he pays. Our service is a bargain. It's a best-seller. It's a buy.

This is as it should be. This is what we have dreamed about and worked for. This is what we have always wanted. I don't mean it is the telephone millennium—of course it isn't—but this service we are providing today is a long, long way ahead of what it was in years gone by. And I'm proud, as you are, that we and our associates in the industry, past and present, are the ones responsible. We're all of us to blame. We brought it on ourselves.

How? Well, each of us could name a lot of reasons, but there are three among others that seem to me particularly important:

First, we have never stopped trying to invent things and think up ways of making the service better. And, fortunately for all concerned, the ways of improvement have been at the same time the ways of economy.

Second, we have kept firmly in mind that the person who wants to telephone may want to call anybody, anytime, anywhere—and we have never forgotten that the only way to make that possible is for every part of our industry to work together in carrying out our joint responsibility.

Third, over the years we have built character, including financial character and high credit standing.

Where the Tides of Progress Trend

Now, with those ideas in mind, let's look at a few present-day events and problems that affect us very closely. We've all heard of moving with the stream, running with the tide, and so on. Nowadays there are some strong tides running that we started ourselves, and it's up to us to navigate them. Take rural service, for example. If telephone service generally were scarce or slow or limited or unreliable, or all of those things, I doubt that many farmers would want it. But the fact is that we have made it generally fast and plentiful and good, and it will take your voice almost anywhere you want to send it, and so of course farm people want it. Why shouldn't they? And we must give it to them.

I know that that is our desire as well as our obligation. I realize, as you do, that the industry has done a magnificent job in extending and improving service in rural areas. I appreciate that the farmers of America have always had a far better and more abundant telephone service than the farmers of any country in the world, and more so today than ever before. As evidence of that, just since the war we have brought about a 50 percent increase in farm telephones, and half the country's farmers now have service, including an increasing number in the more remote areas of the nation.

So we have made great progress in the rural field. But we also know that whatever tastes good whets the appetite for more. Progress sets up a demand for more progress. And just as sure as today is today and tomorrow is tomorrow, if we don't meet that keen continuing demand, somebody else will.

Another development that is running a strong tide today (and here again, we started it ourselves) is the use of radio in telephone communication. Already we have a wide variety of techniques and services in operation, and I am sure there will be more. Years ago we bridged the oceans and now, with radio relay, we are again spanning the continent. The telephone is talking from cars on the roads and from highballing trains, from planes in the clouds and from boats in the rivers and lakes and along the coastal seaways. It is bringing a new security to remote and hitherto isolated corners of the land.

How far will the radio art eventually extend the telephone's frontiers? That is anybody's guess—but if there is one thing we telephone people have learned from experience, it is not to underestimate future potentials. We know we can't foresee the end result of the new ideas and new techniques and new services we set in motion. We can't put limits on tomorrow.

Service of Limitless Scope

After all, we have now shown the world that telephone service is not limited to talking over a wire from an office or armchair. We have pulled aside a curtain and given the public a whole new outlook to explore. Having done this, we must accept the consequences. We must be prepared to serve—not here and there or in bits and pieces—but wherever the need exists. And we must face the fact that if we do not serve in that way, others may jump in to fill the gaps.

One way or another, the public are going to get what they want. They have a right to expect that we will give them what they want. And I am sure that in all these new fields of service, no less than in others, we shall be wise in continuing to make the public's wants our opportunity. As I said earlier, one of the big reasons for the progress of our industry over the years is that we have worked faithfully to the end that anyone might talk with anyone else, anytime and anywhere. In this new era of communications—this new day that stretches out ahead of us—the same principle will be every bit as important in bringing new benefits to the public and success to our over-all efforts.

Why a New Era?

I HAVE CALLED THIS a new era—a new day. It seems to me there are many reasons for calling it that. In addition to the enormous increase in the sheer volume of telephone service, and the use of radio which I have already mentioned, other new developments are coming along apace. Already, operators are dialing about 30 percent of all toll board and long distance calls. Local service areas are being extended geographically, as well as in the number of users wo can call each other without tl charges. Metropolitan service ares are being enlarged. The range f direct customer dialing is increasi and we are not far from the tir when telephone users in certa places can begin to dial at least sor of their own long-haul calls. Cor munity dial offices are multiplyin Television is on the march.

For our customers, much of th progress has the excellent result making the service a great deal mo convenient and simple to use. B for us who give the service, one r sult is greater complexity in oper tions. There is a paradox of a so —we are making things more con plicated in order to make them mor simple. A parallel result is that th operations of all companies in th industry touch each other at mor points. In the working out of eac new step forward, the problems an situations of all companies must b considered in order that the whol public may best be served.

Fortunately, we in this industr have the background, the experience and above all the will to sit dow together and jointly work out satis factory answers to all these prob lems. That is what we have bee doing, are doing, and will continue t do. This applies to radio services It applies to all the problems asso ciated with toll dialing. It applies to community dial projects and the frequent arrangement of having one company do the assistance-operating for another company's CDO.* In short, on all matters of common concern we shall, I confidently expect, keep right on contributing mutually

* Community dial office.

toward solutions that are in the best interest of all our customers.

Problems of Finance

Now I should like to say a few words about the third fundamental that I mentioned earlier as having contributed so much to the progress of this business. I mean the building of character and especially, in this discussion, financial character.

There is no organization in the telephone industry that has not faced tremendous financial problems in the past few years. We have all had them—big companies, medium-sized companies, and little companies. The cost of providing telephone service has gone up, up, and up. Demand for service has required continuous heavy expenditures for new construction and the obtaining of huge amounts of new capital. And the years we have been through have shown us these things:

They have shown that the building of high credit standing over the years is indispensable in order to meet public demand for more service and improving service.

They have shown that in the long run no telephone company can really do a job that is "tops" unless it has adequate earnings.

They have shown the necessity for making every possible effort to bring about the fair pricing of telephone service.

And they have shown that good service, fairly priced in the light of current conditions, is still a bargain that people want more than they ever wanted it before.

So I want to give special emphasis here to the work that is being done to meet problems of earnings and pricing, particularly in the case of small companies for which these problems present the greatest difficulties. Your Association, through its Committee on Problems of Small Companies, is doing a fine job in analyzing situations and mapping practical programs of action. Likewise the work of the state associations is of utmost importance and deserves the active coöperation and support of all of us.

This kind of work seems to me particularly important right now. Bear in mind that demand is once again quickening and is on a rising curve. The defense situation is bringing new problems and we must be prepared to meet them. We need plant margins that we do not now have—and we need them all the more because we do not yet know what sort of restrictions may soon be placed on materials and on plant construction. The situation is urgent, and the first essential is to meet these underlying problems of rates, earnings, and financing as well as we possibly can.

Good Public Relations

There is another thing that seems to me of first importance today. That is that we do everything we can to keep close to the public's thinking and to make our own ideas and policies and problems—and our accomplishments—crystal-clear to the people we serve. I have three reasons for emphasizing this point.

One is that all our experience has shown the necessity of building good relations with the public in order to give the best possible service.

The second is that we now have a new public. We have millions of new customers who don't yet know us nearly as well as the old ones do. They are just beginning to make our acquaintance. Of course, all through the years we have had a steady parade of new customers—but we have never had so many come along so fast as in the last five years. Therefore, while the process of gaining mutual understanding may not be essentially different from what it has always been, we simply have a lot more of it to do.

The third reason I have in mind is that all of us together—the telephone industry and the public—are living in a period of tension and change. None of us can be quite sure of what is going to happen next. But we all feel in our bones that events of the utmost consequence lie ahead. And the challenge to us who render telephone service is that we shall not only so conduct ourselves, but also so present ourselves to the public we serve, that they will have whole-hearted confidence in our ability, sympathetic understanding of our problems and difficulties, and a friendly respect and liking for us as people.

I have been speaking of a new era in communications: of the fulfillment of so much for which we have labored in the past, of the progress of today and the promise of tomorrow. But it must already be clear to you that I am not suggesting we have any reason to be complacent. We have none. Our country today faces great problems and grave dangers—perhaps the most serious we have ever been called upon to face. There are hard tasks ahead, and we shall have to summon all our capacity to meet them.

Building for Progress

But we have the capacity, and the courage to use it. We have built a communication system in this country that is a mighty bulwark of defense—a system far better and more extensive and more efficient than in the years before World War II. We have the knowledge and skill and resources to make this system even stouter and stronger and better day by day. We are an army of men and women 600,000 strong who know our job and know how to do it together. And we have never failed. I am confident, and I know you are confident, that with unity of purpose and consistent devotion to the common good, we shall do our full part in helping to maintain the freedom of the United States of America. And in so doing we shall also, I am sure, write a new and important chapter in the bright record of telephone progress.

The Bell System's Number One Job

A statement by

Leroy A. Wilson

President, American Telephone
and Telegraph Company

THE BELL SYSTEM is well prepared to do its full part in meeting the national emergency. That is the Number One telephone job in 1951. The System has spent five billion dollars since the war to expand and improve the country's telephone network. More than 35,000,000 Bell telephones are in service—twice as many as in 1940. New and improved methods of communication are being more and more used.

The telephone is essential for military and defense production purposes and these will continue to get first attention. Construction work is moving right ahead on many special defense projects. Fast and plentiful telephone communications are equally vital to the expansion of production, and the Bell Companies are determined to meet every such need. Additional facilities will also be required to provide service to people who are waiting. Shortages of materials add severely to this problem, but every effort will be continued to meet civilian needs to the full extent that national policy allows.

With a large continuing construction program and no let-up in demand for service, additional financing has been authorized by the stockholders so that the Bell System may be in a position to obtain new capital when it is needed. To attract and protect the savings of investors, earnings must be maintained at adequate levels. Accordingly, various Bell Companies have applied for further increases in telephone rates and other applications will be made. This must be done in order that the Companies may continue to succeed in providing the service the nation depends on during these critical times.

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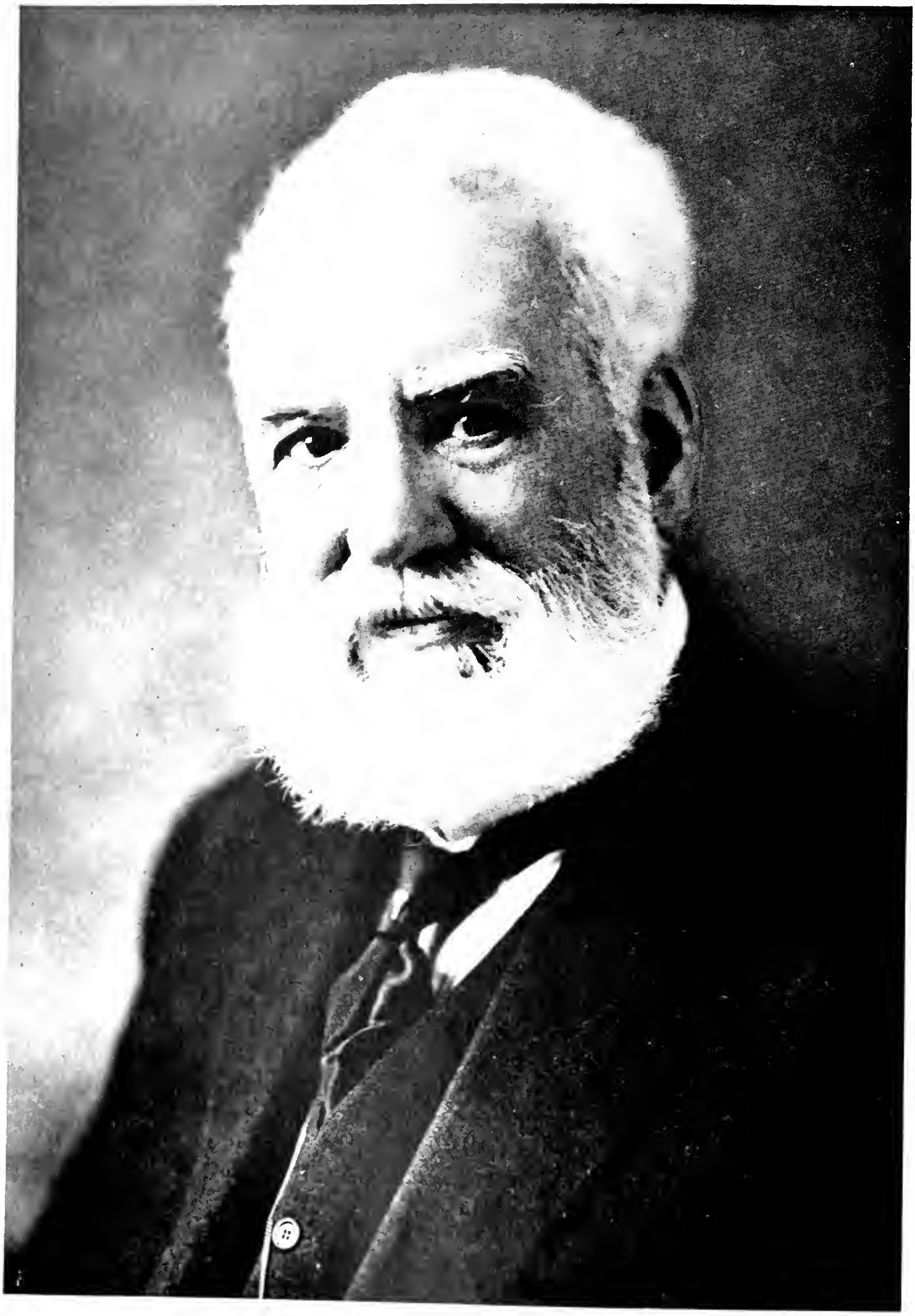


ALEXANDER GRAHAM BELL

1847–1922

Alexander Graham Bell's Varied Interests and Numerous Contributions to the Welfare of Mankind Were Important Factors in the Award of This Signal Honor

The Telephone's Inventor Elected to Hall of Fame

THE YEAR 1951 will include not only the seventy-fifth anniversary of the telephone but the enshrinement of its inventor, Alexander Graham Bell, in the Hall of Fame.

Dr. Bell was one of six famous Americans to be elected to the Hall of Fame on November 1, 1950. Others chosen for this signal honor were Susan B. Anthony, suffrage leader and eighth woman to be elected; Josiah Willard Gibbs, founder of the science of physical chemistry; Dr. William Gorgas, medical scientist, who rid the Canal Zone of yellow fever; Theodore Roosevelt, 26th President; and Woodrow Wilson, 28th President and inspiration for the League of Nations.

The telephone, during the three-quarters of a century since it carried its first complete message, has had incalculable influence upon the world, and has to no small degree shaped the pattern of modern life. It has given employment to hundreds of thousands of men and women, while to countless millions it has come to be an indispensable tool of living. Its importance in business and social affairs, in the maintenance of family ties, and in the administration of government, need no recounting here.

But it was not for the telephone alone that Dr. Bell eminently deserved the honor of a place in the Hall of Fame. Indeed, the telephone is so ubiquitous in our lives that we in the telephone business are in some danger of overlooking his claims to greatness in other fields. He was a versatile genius who contributed to the welfare of mankind in many ways.

A biographical memoir of Dr. Bell, prepared for the National Academy of Sciences in 1943 by Harold S. Osborne, Chief Engineer of the American Telephone and Telegraph Company, gives a comprehensive account of Bell's life. From it is reprinted here that considerable portion which deals with his non-telephonic interests and which gives, we believe, a critical evaluation of this great American's many achievements.

EDITOR.

DR. BELL'S INTERESTS were much broader than telephony, and the breadth of these interests led him to turn his attention into other fields as rapidly as his obligations to the developers of the telephone made this

The Hall of Fame

The Hall of Fame for Great Americans was originated by Dr. Henry J. MacCracken, former Chancellor of New York University, and was made possible by the generosity of Mrs. Finley J. Shepard.

Physically, it consists of an open air colonnade and a massive substructure on the campus of New York University, University Heights, New York City. A bronze plaque is installed for each individual elected, and this is usually followed or accompanied by the unveiling of a bust presented by his or her admirers.

Hall of Fame electors are chosen by the senate of New York University from people of prominence in educational and public life. At least a majority of the electors must concur before a candidate can be elected, and no more than seven may be elected at any one time. Anyone may nominate a candidate for the Hall of Fame, but no nomination will be considered until at least twenty-five years after the death of the person proposed.

Elections take place every five years, and the first was held in 1900. The elections of 1950 increased to 83 the total of great Americans enshrined in the Hall of Fame.

possible. As leisure and wealth came to him from his telephone invention, it became possible for him to devote his time to researches in numerous subjects which interested him and which gave opportunity for further service to mankind.

His Work with the Deaf

Running through all of Bell's adult life is his interest in improving the teaching of the deaf. This began even before he left London, and in this country as early as 1871 he accepted engagements in Boston to explain the application of his father's system of visible speech to teaching the deaf and dumb to talk. At that time, deaf children were generally taught to speak among themselves by sign language. Many leading authorities considered that it was impracticable and a waste of time to try to teach speech to the deaf and dumb—it was even commonly supposed that their organs of speech had been impaired. At one time Bell, as well as his father, had held, as he expressed it, "an obstinate disbelief in the powers of lip reading." Later he became convinced of these powers, partly perhaps through the ease with which he could converse with Mabel Hubbard, who had become adept at lip-reading.

Characteristically, when Bell recognized his misconception he was quick to correct it in an active way. As early as 1872 he began a crusade for recognizing the intellectual possibilities of deaf children and for teaching them to speak and read lips rather than being content to teach them sign language. His influence spread rapidly, helped by the success of his application of visible speech to teaching the deaf to talk. On Janu-

Bell's interest in the deaf was life-long. In this picture of a group of pupils and teachers at the Boston School for the Deaf—"Sarah Fuller's School"—taken in 1871, Bell is at the right at the top of the steps

ary 24, 1874, he addressed the first convention of Articulation Teachers of the Deaf and Dumb and he continued to take an active part in this and other organizations of a similar nature. While this work was interrupted in the years 1875 to 1878 by his activities on the telephone and associated inventions he threw himself into the work again on his return to America in 1878.

In 1880, he received the Volta Award of 50,000 francs for his invention of the telephone. With this he founded the Volta Laboratory Association (later the Volta Bureau), which was largely devoted to work for the deaf. In 1883, after an exhaustive study, he presented before the National Academy of Sciences a memoir: "Upon the formation of a deaf variety of the human race." In this he traced the eugenic dangers of the enforced segragation of deaf people which resulted from teaching them sign language rather than teaching them to speak and read lips. In 1884, he made a plea before the National Eucation Association for the opening of day schools for the deaf as one means of reducing this danger.

There were tendencies for the proponents of sign language and of articulation to break into two hostile camps. However, Bell's conciliatory policy held the group together and led in 1890 to the organization of the American Association to Promote the Teaching of Speech to the Deaf. Bell was President of this organiza-

Experimenting in eugenics for 30 years, Bell developed a flock of sheep whose ewes bore twins or triplets half the time, instead of single lambs

tion and heavily supported its work, giving a total of more than $300,000.

In 1888, at the invitation of the Royal Commission appointed by the British government to study the condition of the deaf, Bell gave exhaustive testimony before them based upon his experience and upon an extensive study of conditions in America. He was appointed an expert special agent of the Census Bureau to arrange for obtaining adequate data regarding the deaf in the census of 1900 in this country and devoted large amounts of time to this work at great personal sacrifice. It is not surprising that at the World's Congress of Instructors of the Deaf held in Chicago in 1893, Dr. Bell was held as the man to whom "*more than any other man* not directly connected with the work, we are indebted for the great advance made in teaching speech to the deaf, and in the establishment of oral schools of instruction throughout the country."

Among the honors received by Dr. Bell, some of those which touched him the most were the naming for him of several schools for the deaf.* Among his many honorary degrees, Harvard College in 1896 gave him LL.D. for his scientific achievements and work for the deaf child.

A Pioneer in Eugenics

BELL'S WORK on the eugenic dangers of the enforced segregation of deaf people led him into pioneer work in the general field of eugenics which, throughout his life, continued to be one of his important interests. In 1918 and 1919 he published the results of extensive studies of longevity and of the betterment of the human race by heredity. In 1921 he was made Honorary President of the Second International Congress of Eugenics at New York City. During the last 30 years of his life he carried on continuously breeding experiments with sheep, leading towards the development of a more prolific breed. These experiments are still going on with the original line in Middlebury, Vermont, with encouraging results.

In spite of all these accomplishments, Bell's incessant activity gave him time to apply his genius with profit to other fields. One of the most important of Bell's inventions outside of the telephone field resulted

* See page 236.

directly from the Volta prize. Bell's interest in speech led to the development by the Volta Laboratory of the engraving of wax for phonograph records, applicable to both the cylindrical and flat disk forms. A fundamental patent was obtained on this now generally used type of record. It is of interest to note that one of the original records developed by Bell and his associates, which was deposited at the Smithsonian Institution in 1881 in a sealed package, with instructions that it should be opened in 50 years, was recently played in the presence of Mr. Bell's daughters and of interested scientists.

Another invention of importance was the telephone probe, an adaptation of the telephone and the electric circuit, to determine the location of a bullet or metallic masses in the human body. In recognition of this, and other inventions, the University of Heidelberg gave him the honorary degree of M.D. in 1886.

Bell lends a hand in hauling down one of his big tetrahedral-celled man-lifting kites. A grandson helps out in the foreground

Experiments in Aviation

Nothing better illustrates Bell's independence of thought than his staunch support of aviation at a time when it was considered so quixotic a subject that Bell risked his scientific reputation in so doing. As Lord Kelvin wrote to Mrs. Bell in 1898, "When I spoke to him on the subject at Halifax, I wished to dissuade him from giving his valuable time and resources to attempts which I believed, and still believe, could only lead to disappointment, if carried on with any expectation of leading to a useful flying machine."

In 1891 Bell contributed $5,000 for Langley's aviation experiments. On May 6, 1896, he saw the successful flight of Langley's steam-driven 16 foot model, which, however, did not carry a man. Speaking of this experience later, he said, "The sight of Langley's steam aerodrome circling in the sky convinced me that the age of the flying machine was at hand."

In 1898, Bell was elected a Regent of the Smithsonian Institution. His enthusiasm for Langley's experiments with small-scale models of a flying machine had much to do with obtaining from the War Department an appropriation of $50,000 to be used by Langley for the development of aeronautics.

Bell (right) watches intently as the DH4 rushes toward him over Baddeck Bay. Rising on steel planes or "hydrofoils" as its airplane propellers give it velocity, the odd-looking vessel (inset in circle) gains speed as its water resistance decreases. It set a 1920 speed record of 71 miles per hour

Langley's full scale model, carrying a pilot, fell into the Potomac on its trial in 1903, and the whole project dissolved in ridicule. However, soon after this the Wright brothers made their epochal flight at Kitty-Hawk, the first man-carrying flight of a controlled airplane. These events further confirmed the abiding interest in aviation of Alexander Graham Bell.

For years Bell had been studying the flight of kites at his summer home, Beinn Bhreagh, in Cape Breton Island on the Bras D'Or. This he considered the best approach to the problem of aviation. By 1901 he was working with a tetrahedral form of kite structure, a form which gave stability. This work was greatly expanded in the following years. Giant kites of multicellular, tetrahedral form were built and flown. In 1907 his huge kite Cygnet I, towed across Baddeck Bay carrying Lieutenant Selfridge, rose to a height of 168 feet.

While Bell's tremendous experimentation in this field was without direct application to aeronautics, indirectly it was of importance. It led Mr. and Mrs. Bell to become patrons of aeronautical research and greatly to advance aviation in this way. In connection with his experimental work, Bell attracted to his home at Beinn Bhreagh a group of talented young men devoted to aviation. In

October, 1907, he entered into an agreement with these men for their joint production of experiments on "aerial locomotion," "all working together individually and conjointly in pursuance of their common aim to get into the air by the construction of a practical aerodrome driven by its own motive power and carrying a man." This organization was named the Aerial Experiment Association, and its work was financed by Mrs. Bell. The Association included Bell, Glenn H. Curtis, F. W. Baldwin, J. A. D. McCurdy, and Lieut. T. Selfridge. Bell was chairman.

The Aerial Experiment Association, during its one and one-half years of activity, principally at Hammondsport, N. Y., made important contributions to the development of aviation. In March 1908, their first machine, piloted by "Casey" Baldwin, made an important public flight, rising 10 feet above Lake Keuka for a distance of over 300 feet. One of the achievements of this flight was a demonstration of the aileron as an improvement over the wing-warping method previously used by the Wrights for obtaining stability. The aileron is fundamental to all airplane construction today. The second machine of the Association introduced the doped fabric which played so important a part as a wing cover through 20 years of the development of flying. The third machine, designed by Curtis, flew so well that it was entered for the *Scientific Ameri-*

Another concept to which Bell devoted interest and study was the condensation of fog to furnish fresh water for men adrift at sea. Here he conducts an experiment at his summer home in Nova Scotia *can* trophy for the first public flight of one kilometer, straightaway. The flight was made July 4, 1908, and the trophy won. The fourth machine of the Association used balloon fabric for the wings and proved very successful. In the winter of 1909, McCurdy made repeated flights at Beinn Bhreagh, sometimes doing nine miles at a stretch. The Association was dissolved at midnight March 31, 1909, with a resolution by the members "that we place on record our high appreciation of her (Mrs. Bell's) loving and sympathetic devotion without which the work of the Association would have come to naught."

As in the case of his work on the telephone, Bell's activity for the advancement of aviation was stimulated by a prophetic vision of the future importance of developments in this field. In 1908, asked by the editor of *Century* to comment on proofs of an article by E. C. Stedman entitled "The Prince of the Power of the Air," Bell wrote: "While, of course, the bird is Nature's model for the flying-machine heavier than air, Mr. Stedman is undoubtedly right in looking upon the fish as the true model for the dirigible balloon. It is certainly noteworthy that the dirigible war-balloon of today already approximates the fish-like form predicted by him. He is also right I think in supposing that of all the nations in the world the interests of Great Britain will be most vitally affected by progress in aeronautics. For it is obvious that sea-power will become of secondary importance when air-power has been fully developed throught the use of dirigible balloons and flying machines in war. The nation that secures control of the air will ultimately rule the world."

Bell the Individual

This brief description of some of Bell's chief accomplishments gives also an indication of some of his outstanding personal characteristics. He was one of driving energy, insatiable scientific curiosity, independence of thought and individuality of action. As a young man, he was tall, dark with flashing eyes, somewhat frail in appearance. He was described by an observer in 1877 as follows: "Professor Bell is a man of most genial and kindly presence, so courteous and gracious in manner that you could not feel yourself an intruder though you chanced to drop into his room when some private class was under special training. At the same time though his affability sets you at ease, you could not fail to observe that he is one of the busiest of men, so intent upon the development of plans which occupy his life that he has no leisure for visitors who are not interested in his work. He is young, apparently not more than five and thirty (he was just 30) with an unusually prepossessing countenance; very happy in his expression; of pale complexion with jet black hair brushed up from his forehead and pleasant, sparkling black eyes—the face of a man all engaged in his work and finding satisfaction in it."

Later in life, Bell's health became more stable, his frame filled out, his hair became white and his whole appearance impressive and commanding.

Few men are so honored while they live. Bell here stands before a memorial erected in his honor at Brantford, Ontario, and unveiled by the Governor General of Canada in 1917

Bell's code of honor included scrupulous regard for the exact description of his own contributions to inventions or researches and credit to those of others. He was present at the Second Annual Banquet of the Aerial Club of America shortly after the successful flight of the first machine of the Aerial Experiment Association. Cheered to his feet by prolonged applause of this performance, he said, "I really had nothing to do with the success of the experiment. The credit for its success was due Mr. G. H. Curtis, Mr. F. W. Baldwin and Mr. J. A. D. McCurdy. . . . In this company of experimenters I must include Lieutenant Selfridge of the United States Army and Mrs. Bell who supplied the capital for the scientific experiments to get the machine into the air."

His appreciation of assistance and encouragement received from others was warmly felt and often expressed in some tangible and suitable way. Though Joseph Henry died before the telephone was well established, Bell saw to it that an instrument was installed without charge in Henry's residence for the use of his family, "in recognition," Bell said, "of the efforts and services of Prof. Henry in the early history of the instrument and who did a great deal to encourage the inventor."

Bell's services to the promotion of science extended far beyond his own researches. From 1898 to 1903, he was President of the National Geographic Society and did much to develop the policy of that Society and of its magazine in the channels which have led to the present tremendous membership and influence. He served as Regent of the Smithsonian Institution from 1898 until his death. In 1890, a generous gift by him helped start the Astrophysical Observatory of the Institution and in 1894 he brought the body of James Smithson, founder of the Smithsonian Institution, from Genoa to Washington

Bell's Many Honors

Honors came to Bell in great number. Some of these have been mentioned in the discussion of his achievements. He received a large number of honorary degrees from universities in America, in the British Isles and in Germany. He was elected a member of the National Academy of Sciences in 1883. He was made an Officer of the Legion of Honor of France in 1881. He was awarded a medal by the Louisiana Purchase Exposition in 1904, the John Fritz Medal from a group of national engineering societies in 1907, the Elliott Cresson Medal from the Franklin Institute in 1912, the David Edward Hughes Medal from the Royal Society, London, in 1913; the Thomas Alva Edison Medal by the American Institute of Electrical Engineers in 1914, and the Civic Forum (New York) Medal in 1917. In 1917 the Governor General of Canada unveiled a Bell Telephone Memorial erected in his honor at Brantford, Ontario, in the Alexander Graham Bell Gardens and dedicated the Bell homestead and grounds as part of the public parks system of Brantford. In 1920, his native city of Edinburgh elected him a Burgess and a Guild Brother of the city and conferred upon him "The freedom of the city of Edinburgh in recognition of his great achievement in the solution of the problem of telephone communication and of his brilliant and distinguished career as a scientist." This was an honor which deeply touched his heart.

Early in his professional work Bell determined to become a citizen of the United States, taking out his first papers in 1874 and receiving his final papers in 1882. He was immensely proud of his American citizenship, which, as he stated, was his by choice rather than by accident.

Bell's Personality

In the later years of his life, Bell spent more and more time at his summer estate, Beinn Bhreagh, in Nova Scotia. Here, on August 2, 1922, he died. Here he was buried on the top of a mountain in a tomb cut out of a solid rock, with the epitaph, "Died a citizen of the U. S. A." During the ceremony, every telephone on the continent of North America was silenced in honor of the man who had given to mankind the means for direct communication at a distance.

Not only did Alexander Graham Bell leave the telephone as a perpetual memorial to him but the influence of his personality remains strong on those who knew and loved him. Even now, 20 years later, a scientist who for many years knew him well, writes, "The fact that he never spoke disparagingly of others was a remarkable trait, the value of which nowadays I appreciate more than I did when he was alive. I miss his personality more than that of any other human being who has come and gone in my life."

A New Medium of Transmission Is Taking Its Place Beside Open Wire, Cable, and Coaxial Systems as a Conveyer of The World's Telephone Messages

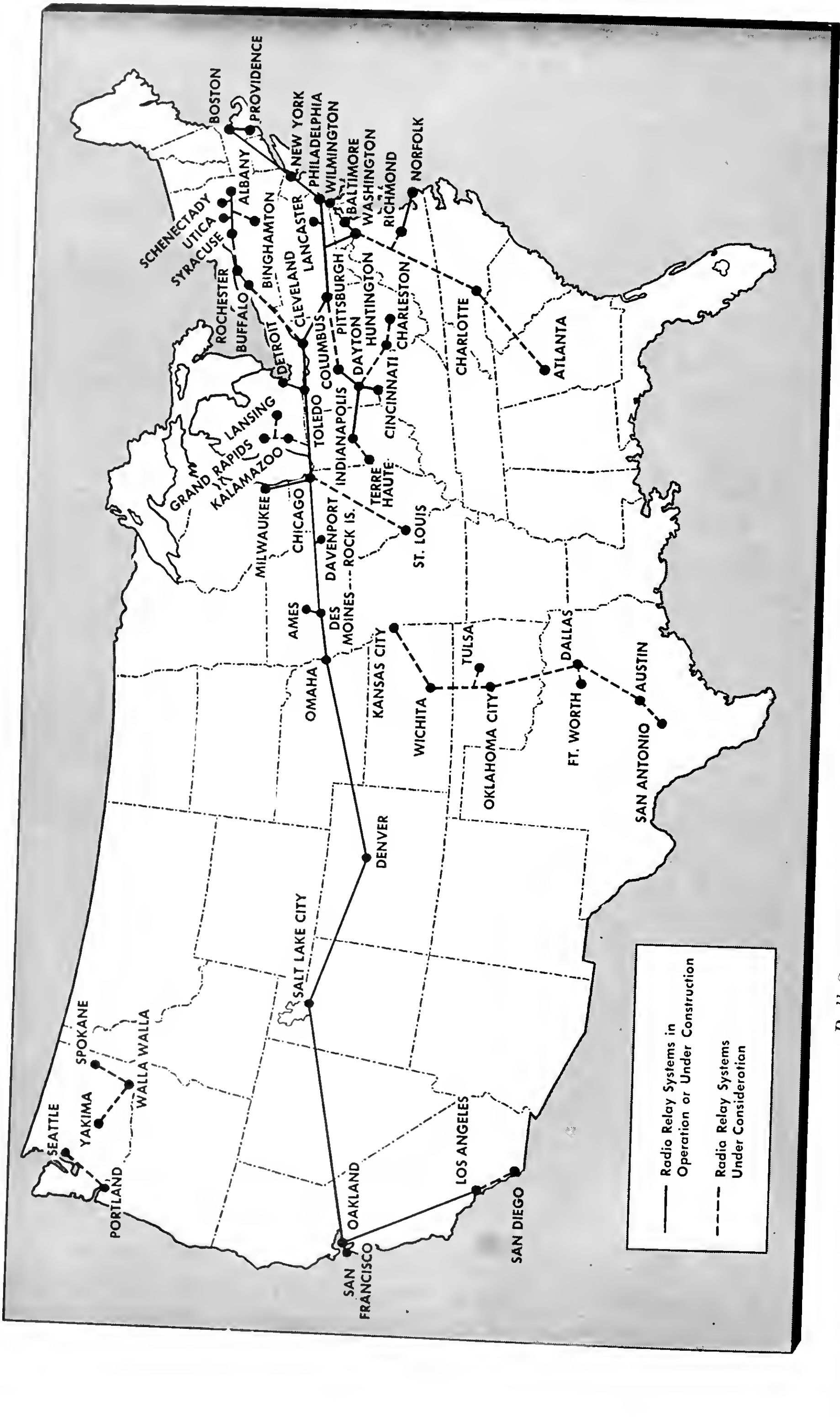
Spanning the Continent By Radio Relay

Richard D. Campbell and Earl Schooley

THE TELEPHONE ENGINEER'S vision of bundles of telephone circuits or of television circuits spanning the country by radio is now close to realization. A radio system is being built overland between New York and San Francisco which will be capable of handling hundreds of telephone messages and several television programs. Already it is being used from the East Coast to Omaha—1,300 miles—and in 1951 the new system will push westward another 1,700 miles from Omaha to link the East Coast and the West. Over one hundred telephone circuits—only a small part of its ultimate capacity—are planned for operation initially in the section west of Chicago.

Completion of the transcontinental system will make it possible for the first time for hundreds of people to talk and for millions of people to see by radio from coast to coast. This is indeed a momentous engineering achievement. It brings to the public the benefits of the coördinated research, development, manufacturing, construction, and operating program of the Bell System in further harnessing the laws of nature and developing the use of the radio spectrum, one of the natural resources of the country, to provide improved communication facilities to the nation.

Several wire routes, two of which are cable, already connect the East and West Coasts. But additional facilities are needed, and radio relay is being used for this new transcontinental system because it affords an economical means of providing them. This does not mean that radio relay will replace existing means of



Bell System radio relay routes in operation or under consideration wire communication. On the contrary, wire facilities will continue to provide the bulk of the nation's communication facilities for the foreseeable future. Radio relay will be used in preference to other forms of communication where this appears to afford definite advantages. The decision will be based in each case on a consideration of all the factors involved, including cost, reliability of service, and performance. This long-run policy will thus continue to insure the telephone-using public of the best possible service at the lowest possible cost.

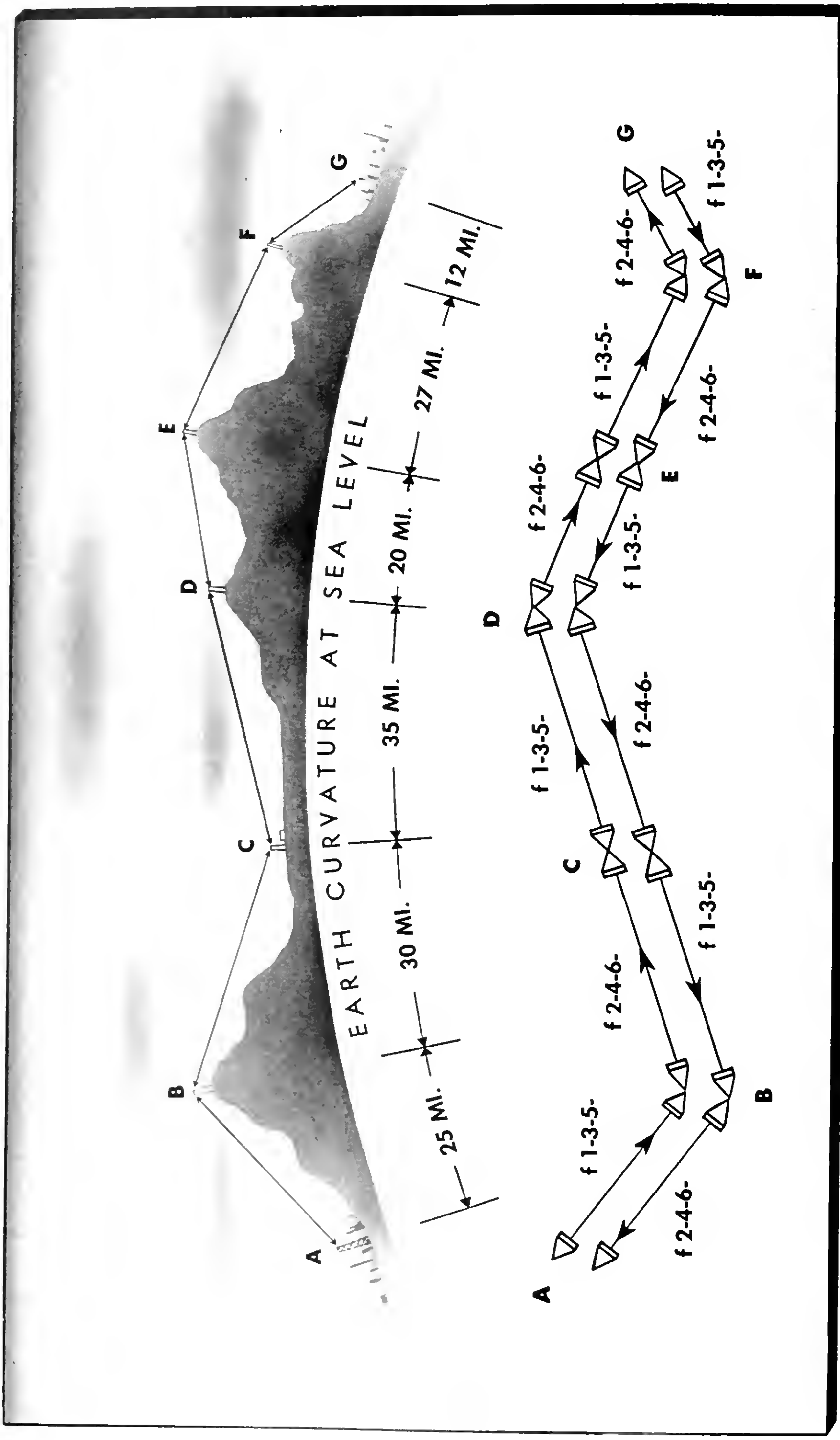
Widening Radio's Field

Until quite recent years, radio has proved useful in the Bell System principally as a means of communicating with ships and other mobile units and with points that could not readily be reached by wires; but the development of new radio relay systems has greatly broadened its field of use. Wires and radio have in common, however, the fact that research and development over the years have increased the capabilities of each to carry more and more telephone circuits. Forty years ago, it was difficult to make even one speech channel operate successfully over a pair of wires for any great distance, and radiotelephony was just entering the experimental stage. Today, telephone conversations are being "stacked up" sixteen deep on a pair of wires on a pole line, cable pairs carry a dozen messages, and a pair of coaxial tubes may transmit as many as six hundred long distance conversations at one time.

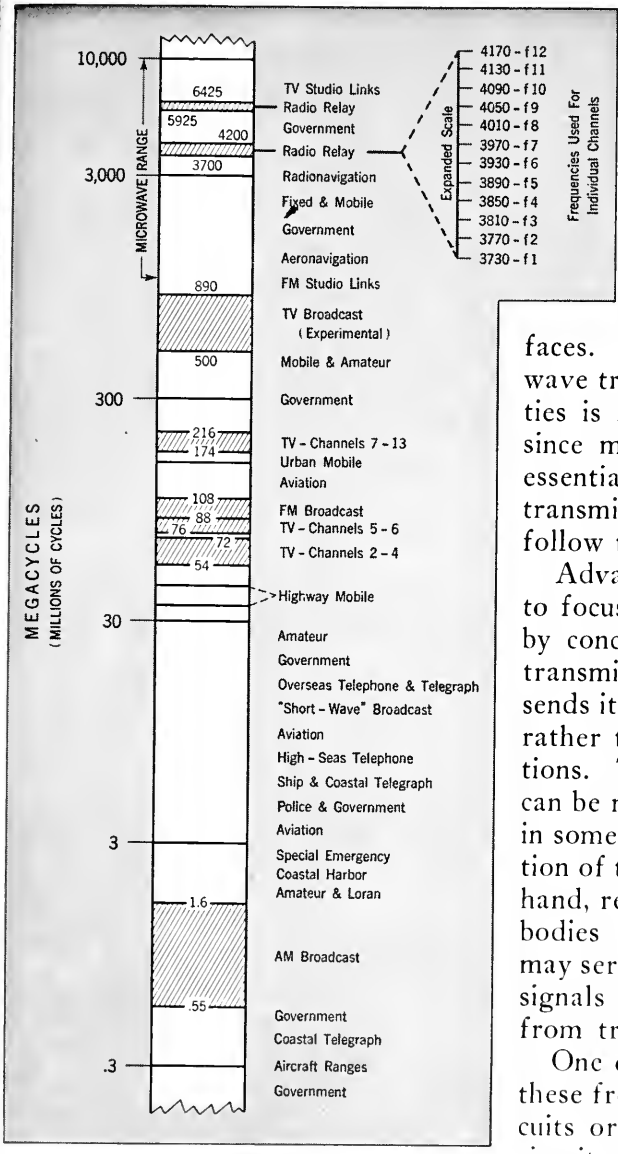
The radio relay systems now taking their place in the telephone plant alongside those facilities are the result of similar growth in the radio art. A radio system placed in operation in 1920 between Long Beach and Catalina Island, Cal., produced one telephone circuit. Today, a radio system from Los Angeles to Catalina carries eight speech channels. Commercial overseas radiotelephone service was first opened in 1927, between New York and London, with one speech channel per radio system. Today, overseas radio systems handling as many as three or four telephone circuits are in use, connecting us with some 90-odd countries. A radio system installed in 1941 to span the mouth of Chesapeake Bay has grown from the initial ten to 22 telephone message channels.

The radio relay system being built across the country will be able to carry hundreds of telephone circuits, yet there will be no pole lines or cables to construct and maintain across mountains, rivers, and plains. Instead, radio relay stations are constructed at intervals of about 30 miles on the average, and maintenance will be needed, therefore, only to keep the structures and the equipment at these stations in proper condition.

The newly developed radio relay system operates in the 4,000 megacycle range (4,000,000,000 cycles), where the corresponding wave length is extremely short. It is, actually, about three inches long, as compared to wave lengths of about 1,000 feet for frequencies in the middle of the standard broadcast band (550–1,600 kilocycles). Waves of this length are known as microwaves, and they have many characteristics similar to light. These characteristics prove



The upper diagram represents a section of radio relay route, showing stations located to permit line-of-sight transmission. The lines between towers indicate direct radio paths, the span length being determined by considerations of attenuation, noise, and fading. Below is a corresponding map of the route, showing the two directions of transmission on separate beams. The route is zigzagged to avoid possible interference between sections using the same frequencies



The location in the spectrum of the frequencies used for Bell System radio relay transmission is shown above with respect to certain other radio services. The individual channel frequencies are indicated on the expanded scale at the top right of the diagram. They are identified as f1, f2, f3, etc., to correspond to the frequencies shown on the diagram opposite. Use of a logarithmic scale is essential here, since a legible linear scale including the same information would be many feet long

useful in many ways, but they also complicate the design and operation of a radio relay system in certain respects. The microwaves can be focused into a beam in the same way a searchlight sends a beam, and they can be reflected from relatively flat surfaces. The range of reliable microwave transmission with present facilities is limited to line-of-sight paths, since most of the energy travels in essentially straight lines from the transmitting antenna and does not follow the earth's curvature.

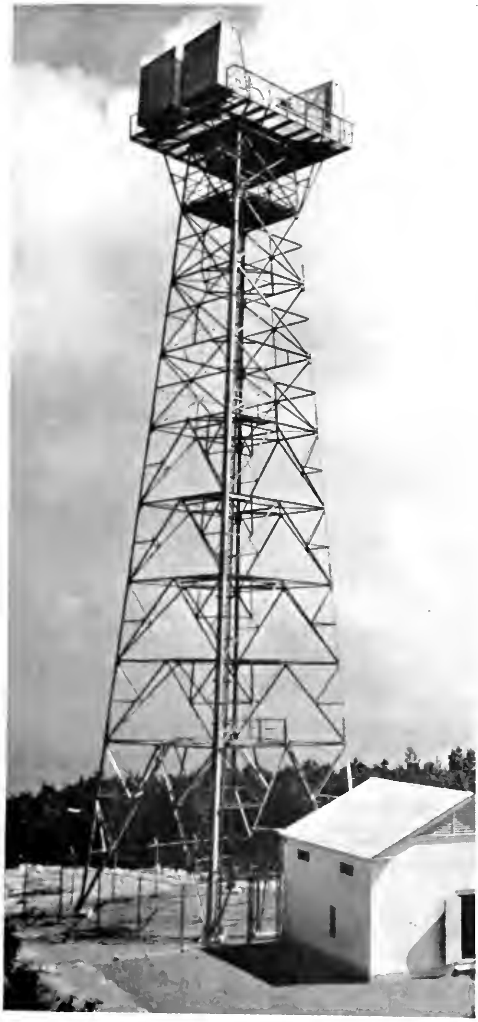
Advantage is taken of the ability to focus the microwaves into a beam by concentrating the energy from a transmitter into an antenna which sends it to a particular radio receiver, rather than scattering it in all directions. The fact that such frequencies can be reflected has been made use of in some instances to change the direction of the radio beam. On the other hand, reflections from salt flats, large bodies of water, or treeless plains may seriously interfere with the radio signals traversing the direct path from transmitter to receiver.

One of the basic reasons for using these frequencies is that television circuits or large numbers of telephone circuits need a very broad frequency band—three or four million cycles or more in width. In order to find space in the spectrum where bands several million cycles wide could be obtained, it was necessary to turn to the microwave frequencies.

Selecting a Route

A SMALL ARMY of people must coordinate their efforts in order to establish a radio relay system. Once a decision is reached to build such a system, engineers study the topography of the ground, using the best maps available, and pick a tentative route.* Since the earth's curvature must be taken into account in finding line-of-sight paths, it is natural to seek elevated sites for repeater stations in order to extend the distance between them and thus minimize the number of stations required. Hilltops are likely to make good repeater station locations. Elevations are desirable that will permit sending the radio frequencies about 30 miles on the average.

* See "Radio Relay and Other Special Buildings," MAGAZINE, Spring 1950.



The steel skeleton tower supports the antennas on its summit, and carries the connecting "plumbing" to them; the house contains the radio equipment, the power supply, and the emergency generator

Remembering that the radio equipment has to be cared for, a site which is inaccessible during the winter months will probably not be satisfactory, despite any other advantages it may have. Remembering, too, that microwave frequencies can be reflected, relatively flat sections of the earth's surface—including water-covered areas—must be avoided or else crossed in such a way that, if reflections do occur, no serious harm will be done.

When the map work is complete, crews go into the field to study the locations selected from the maps. In some areas, the only maps available are based on surveys made more than 60 years ago. In several cases, hills appearing on these maps were found, on field check, to be incorrectly located. Locations picked from maps were often found to be already occupied by farm buildings or, in some instances, by radio stations.

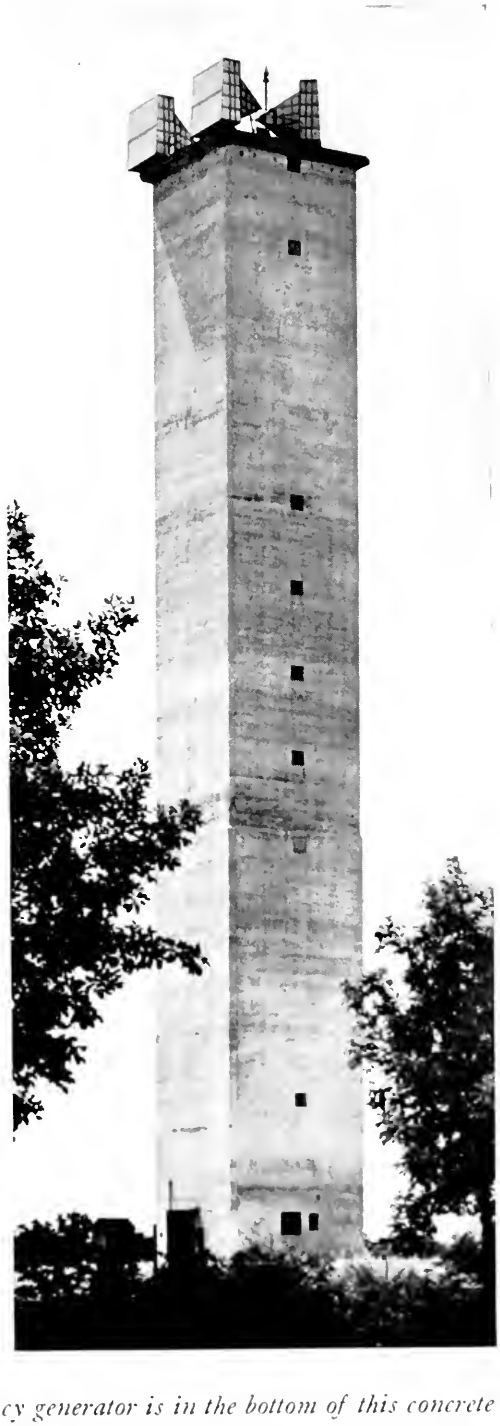
Sometimes hilltops with good access, power supply, and other advantages cannot be used because higher hills, trees, or city buildings are in the line-of-sight path, or because of restrictions imposed by local or federal laws. Even though hilltops are used, towers are required in some locations to provide an additional 200 eet or so of height which may be necessary for reasonably long line-of-sight paths to the next relay points.

Tentative sites for the antenna towers are picked and temporary towers are erected. These towers are used to support special radio test equipment to check the path to the next adjacent site. This check may indicate that the tentative site selected is not satisfactory because of bad reflections, or because the path is obstructed by a hill or by a large structure, such as a water tank. The tests may also indicate that shorter or taller towers are required than the preliminary review seemed to indicate. Other tests are made on the soil, to determine the nature of the tower foundation required.

Since a shift of even a few hundred feet in location of a relay site may affect the tower height and location of the two adjacent repeaters, no sites are purchased until there is reasonable assurance that all sites on a route are satisfactory.

Once the sites have been secured, bids are obtained from contractors for the foundation and erection work at each location. Roads must be built, power brought in, and other facilities provided which are not generally at hand in the remote locations usually chosen for radio relay points.

About ten months later, if all goes well, the buildings and towers will be complete and the radio equipment and antennas will be on the ground ready for installation.



The antennas are on the top and the emergency generator is in the bottom of this concrete building; the radio equipment and power supply are inside, about half-way up. The airplane warning beacon required on most such towers is visible between the antennas

Using Microwave Frequencies

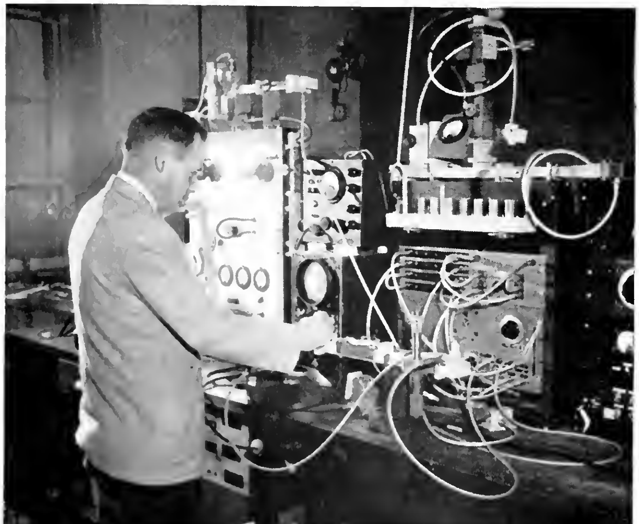
The equipment used in the radio relay system consists of the same basic elements as are used for other Bell System radio services. These include radio transmitters, radio receivers, and antennas. The main differences between the radio relay equipment and that used for the other systems are the use of microwave frequencies, the new techniques involved in the apparatus design, and the ability of the equipment to handle wide frequency bands.

The functions of the radio equipment can be readily understood by following a simplified account of the course of a signal passing over the system.

The signal to be transmitted is superimposed on the transmitting frequency, which lies in the range from 3,700 to 4,200 megacycles. This radio signal is amplified and then sent to an antenna, where the energy is concentrated in a narrow beam directed through space toward the first repeater station along the route. Since the energy is concentrated, it is not necessary to use the millions of watts which would be required if the energy were scattered in all directions, as in radio broadcasting. Instead, the actual radio power output is only half a watt, or about the same amount of energy required to operate a flashlight bulb. Yet to obtain the power to provide adequate amplification and this amount of radio energy, several hundred watts of input power is required.

The relay station receives the relatively weak microwave signal, amplifies it to make up for the loss it has suffered in spanning the distance from the preceding station, and sends it on to the next station. This process is repeated over and over again at successive repeater stations located at intervals along the desired routes. A signal transmitted over the entire system between New York and San Francisco will, incidentally, pass through 105 relay stations.

At the distant terminal of the radio relay system, the signal, after amplification, is restored to its original form. If it is a television signal, it is ready for delivery to the broadcast station. If the signal consists of a group of telephone circuits, it must be con-



A Bell Telephone Laboratories engineer conducts experimental work on a transmitter-modulator unit of radio relay equipment, shown at the upper right iected to equipment similar to that ised in coaxial and other carrier sys-ems, which performs the feat of un-crambling each telephone conversa-ion from the others before delivery ver individual circuits to the custom-rs' telephones.

This account has traced the course f a signal transmitted over a radio elay system in one direction only. For two-way service, such as is neces-ary with telephone communication, quipment must also be provided for ransmission in the reverse direction. The traffic on many routes may re-uire the installation of additional adio equipment for the broad-band hannels which would be necessary to andle more bundles of telephone ircuits or additional television rograms.

A single radio relay antenna may ransmit as many as six broad-band hannels in one direction. Another ingle antenna may receive the same umber. Hence, only four antennas n all—one transmitting and one re-eiving antenna side by side facing in ne direction and a similar pair fac-ng in the opposite direction—will uffice at each radio relay point along a route equipped to handle six broad-band channels in the two directions.

If a branch route takes off from a relay station in a different direction, an antenna is also needed for trans-mitting toward and another for re-ceiving from the new direction.

Microwave Transmission

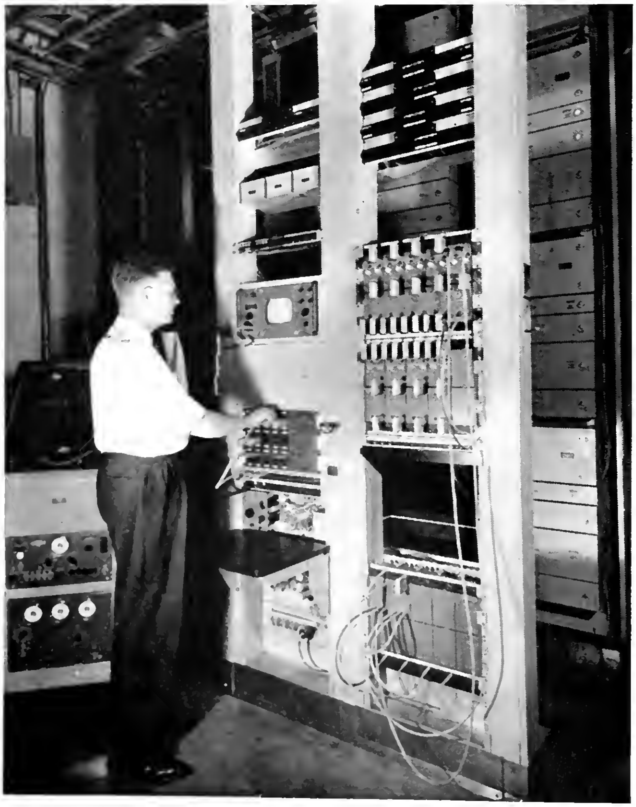
Every advance in telephone science and telephone service represents fore-sight, long-range planning, guided and coördinated attack upon a prob-lem, and a practical solution. In this

Here are the elements of the close-spaced microwave triode. The upper and lower items at the right are the tube base holding the heater leads and the tube envelope; the rest are components. The inch scale indicates the small size of the tube

pattern, radio relay is the outcome of long and fruitful effort by the Bell Telephone Laboratories, and its in-stallation bespeaks the utmost skill and manufacturing precision by the Western Electric—the Bell System's division of manufacture and supply.

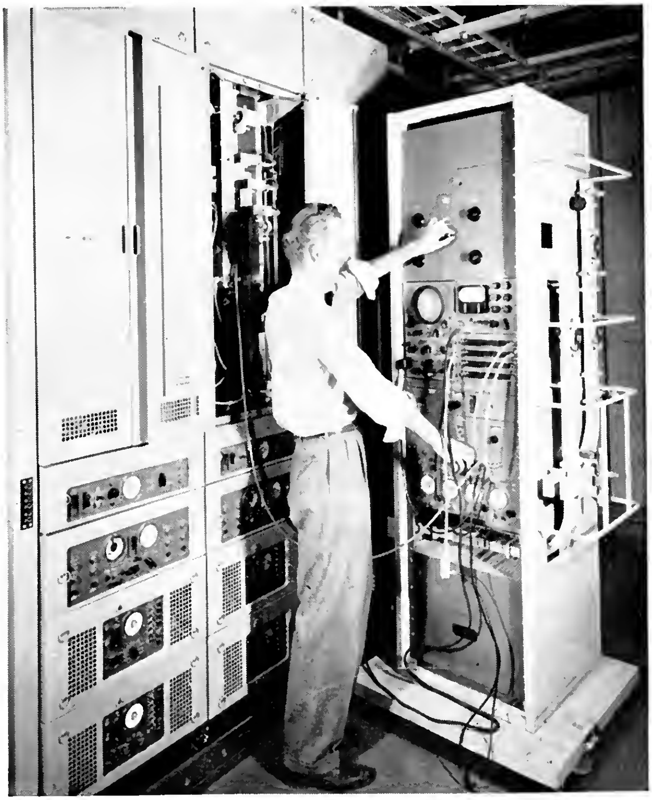
A better appreciation of the devel-opment and manufacturing effort re-quired in producing the radio relay equipment can perhaps be obtained by considering a few of the compo-nents involved. Take, for example, the close-spaced microwave triode (Western Electric Type 416A micro-wave vacuum tube), which is the very heart of the equipment. It is used to generate and amplify the extremely high frequencies employed for trans-mission. This tube, which is about the size of an English walnut, is the same in principle as any ordinary three-element vacuum tube having a cathode, grid, and plate. The placing of these elements in the extremely small space required to make the tube work at these frequencies is a triumph of design and manufacture. The grid structure employs wire only about one-tenth the thickness of a human hair, and the distance between the grid and the cathode is one-fifth the diameter of a hair. Certain critical parts are gold-plated to resist corrosion. Six such tubes are required for each one-way channel at each relay station.

At microwave frequencies, the energy is easily radiated, and therefore ordinary wire connections cannot be used for guiding these frequencies from one place to another. It has consequently been necessary to guide the energy by means of pipes or tubes, called waveguides, and frequently referred to as "plumbing." Sections of waveguide are made in various lengths and shapes, including elbows and other bends, twists, and straight sections. A cross-section is about half the size of a playing card. The various sections are bolted together by means of flanges. Dents and other deformations of the waveguide and flanges must be guarded against because, even when relatively minute, they are likely to result in transmission irregularities.



This man is watching a video monitor in a patching bay at a radio relay station where a branch connection is provided to a television broadcasting station. A test console may be seen at the left

Microwave transmission would not be practicable without highly directive antennas, and these too deserve particular consideration. The type normally used in the radio relay system is made of metal, and acts in the same manner for microwave frequencies as a glass lens does for light waves. For this reason, it is commonly referred to as a lens antenna. By the use of such an antenna, the microwave frequencies can be focused into an extremely sharp beam. Lens antennas are used for both transmission and reception. If non-directional antennas were used, the output of the transmitter would have to be increased to about 50,000,000 watts of power, instead of the one-half watt used with the lens antennas, in order to produce the same transmission effectiveness.



The three large cabinets at the left—one with its door open for testing—are radio transmitter-receiver bays. The equipment in each serves as a relay station to receive, amplify, and transmit one broad-band channel in one direction. The test bay with which the man is working is used to locate trouble and to make routine checks of the equipment

Equipment has been developed for use at the repeater stations and at special maintenance centers to assist in determining the over-all performance of the radio equipment during routine testing or to locate the source of troubles which might develop.

The reliability of service over the radio relay system can never be better than the reliability of the power supply from which it operates. For this reason, the equipment is operated from storage batteries. Commercial power is used as the primary source of energy at most stations. However, to insure continuity of service, a standby gasoline or diesel engine generator, capable of automatically taking over the load in case of a failure of commercial power, is installed at each station.

Rectifiers which provide the required current supply for the batteries are installed in duplicate, and if one fails, the other takes over automatically. The storage batteries are capable of carrying the load for six to eight hours, which is generally time enough for a maintenance man to get to a station if something should go wrong; and in some locations difficult of access, a larger battery is used which is capable of carrying the load for as long as 24 hours, further insuring continuity of service.

Since the repeater stations are de-

This radio relay station, under construction on Mt. Rose, Nev., is nearly two miles above sea level, the highest elevation of any station in the entire transcontinental system

signed for unattended automatic operation, a control system is used to provide information at special maintenance or alarm centers concerning the operating condition of the individual stations. The system produces a visual and an audible signal at the alarm center when trouble develops at an unattended station. Upon receipt of such an alarm, 42 different alarm conditions at the unattended station can be checked from the alarm center. These conditions range from an open door at the station to failure of a rectifier or the failure of an aircraft tower warning light. The alarm center is thus apprised promptly of unsatisfactory conditions at the unattended stations, and remedial action can be taken.

In a long radio relay system, the maintenance work must be carried on from regional maintenance centers located at strategic places having access to the individual stations along a section of route usually ranging from 100 to 300 miles in length. A special telephone circuit is provided to interconnect the individual stations in each of these sections with their associated alarm and maintenance centers. To facilitate coördination of the maintenance work in the individual sections, another circuit is provided which interconnects only the terminals, the main stations, the alarm centers, and the maintenance centers of an entire system—such as the one between New York and Chicago. These circuits are usually provided by wire, but separate radio facilities have been used in a number of cases to connect relay stations at remote points.

Problems and Capabilities

The Bell System is now operating some 8,150 channel miles of broadband radio relay systems. Seventy percent of this mileage is provided by the use of the newly designed microwave equipment, and most of this was placed in regular service in September of 1950. All of the radio relay facilities at present in service are being used commercially for television transmission. The experience to date with the newly developed equipment confirms the expectation that this system can transmit present-day television signals over very long distances with excellent results. Test pictures transmitted twice around the New York-Chicago system, a distance of approximately 3,300 miles, can easily be mistaken for pictures which have been transmitted only over local pick-up facilities.

As may be expected with any new development, some equipment difficulties were experienced during early tests of the microwave radio relay systems. Unexpected sources of noise and transmission irregularities had to be tracked down and minimized or eliminated. Equipment troubles were studied and the necessary corrective action was taken. Plenty of coöperative effort made it possible to place the system in regular operation on schedule.

On the operating side, men had to be trained in large numbers to assume the maintenance and operating duties involved in the use of this new form of communication system. Here, too, the successful operation of the systems now in use speaks well for the manner in which this program was carried out, and for the hard work, loyalty, and skill of the plant personnel.

Tests made on the New York-Chicago system give further support to laboratory tests proving the practicability of carrying large groups of telephone circuits over transcontinental distances. Needed telephone circuit facilities are to be provided by the use of radio relay systems on a number of routes during 1951—including service over the Chicago-San Francisco route. Present plans contemplate that by the end of 1951 the total channel miles of broad-band radio relay systems in operation will have increased to nearly 25,000. Of these, about one-third will be equipped to provide a total of about 800,000 circuit miles of telephone circuits.

There are still things to learn about radio relay, and of its future no man can speak with certainty. But already radio relay has shown that it will have a vital part to play in meeting the communication needs of our nation, in peace or in war. The thousands of miles of radio relay now in service and being constructed will take their place alongside open wire, cable, and coaxial systems as a conveyor of the world's messages.

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A Library Shelf

SEVERAL ROWS of bright green boxes stand handy on a shelf by the entrance to one of the large reading rooms in the New York Public Library. Many a scholar headed for serious investigation into the War of Jenkins' Ear or into sources on the life of the Aga Khan notices those boxes, and stops, looking as if stopping were the last thing in the world he intended to do. He takes a paper-bound book from one of the boxes, then settles down happily in a near-by seat. Serious research can wait. The scholar is going home again, back to the town he came from twenty years ago or more, by courtesy of the home town telephone directory.

THE LIBRARY now has a copy of almost every telephone directory in America. Anyone who wants to know Frank Glasgow's number in Sweetgrass, Mont., or Joe Whaley's number in Snow Hill, Md., need only stop in. A call to Information on the phone will produce the same thing, of course, but that's business. The pleasure is in taking up the directory for the long-unvisited home town and in seeing what's happened there, as the telephone directory shows it.

For one thing, the town has grown bigger. The directory of 1920 was a small volume. Today it has expanded in all directions and is an inch thick. It mentions a lot of new suburbs that didn't exist thirty years ago, places tagged with the color-drained names that are the unique pride of suburban realty developers: Hillcrest, Meadowlawn and Brookside. Amid this rocketing expansion some landmarks remain: Stolzfuss' grocery, where the old man probably still refuses to sell cigarettes to 12-year-olds, and Potteiger's drug store with its marbly soda fountain and the jars of colored water in the window. Not even the phone numbers, dimly recalled, have changed. Not so, with people. There used to be a clan of Shollenbergs, a family of six or seven brothers, that filled a house on their frequent reunions. The name does not appear in today's directory. A fair number of people have moved, to the suburbs or to the outskirts of town. Others are vanished, to the larger cities or perhaps to the cemetery on the hill. (Caretaker's residence: 3346–J.)

THE LIFE STORIES of some of the people still at home can be read in the directory. Joe Dunkleberger, one of a family of twelve kids, who had to quit school at 11, is still in town. His phone is listed with an address in the snootiest suburb and his insurance office is in the new Dunkleberger Building. Carl Brown, who once hoped to get to sea to escape the most climbing ivy of mothers, still resides in the same house on South Fourth Street, now in the factory district. His mother always said she would never give up that house as long as she lived. Snooky Jones, maker of gray hair for teacher and truant officer in all eight grades, is now listed as Rev. William D. Jones, D. D. And Mary Elizabeth Hettinger, once the prettiest, richest and most marriageable girl in town, is listed as "Miss" and resides at the Normandie Vista Apartments. She never could decide which beau she liked best.

THE LIBRARY'S COLLECTION of telephone directories is a mass of prime source material if the historian first knows a little about the sources. The earnest ladies who work daily in the Local Room at the Library, chasing down the twigs and branches of genealogical trees for those still concerned about their ancestors, might well wish for a collection of something like those directories for the years 1620–1850.

For those books show two historical facts absolutely beyond argument: that on a certain day so-and-so lived at such-and-such an address and was solvent enough to pay a phone bill.

From the *New York Times*, by permission

Visual Presentation Is One of the Means through Which The Bell System Meets Its Obligation to Tell Users about The Telephone and How It Serves the Nation

Showing Our Customers the Elements of Good Service

Walter V. Brown

MEETING more than eleven million folks face to face!

That was the job the Bell System carried out in 1950 to *show* customers what makes good telephone service. It was done at fairs, trade shows, open houses, and museums. And it follows the axiom of this business that "The more that customers know about the telephone, the more satisfactory will be their use of it."

The business believes it is obligated to tell the public about its instruments and equipment, its personnel, its policies and objectives—about the innumerable aspects of America's largest single enterprise, which provides Americans with the best telephone service in the world.

The Bell System uses many channels of information to reach its customers. The best known of these are newspaper and national magazine advertising, the Telephone Hour and allied radio programs, and Bell System motion pictures.

The advertising and radio programs are effective with many thoughtful people. Systematic measurements tell us this. And during 1950, the Bell System motion-picture audience totaled almost 50 millions.

There are, in addition, many millions of customers to whom visual education programs have a special appeal. They are the folks who "go places" in crowds—to ball games, fairs, museums, trade exhibitions—any place there's a show going on. Such people are interested in their own affairs, not in the telephone business. Yet, as customers, they are entitled to information about the business. These individuals are best approached on a face-to-face basis. And it is to this audience that "displays" or "visual presentations" are directed.

good neighbors—like themselves. Small wonder, then, that studies show a much more favorable attitude toward the telephone company after a central-office visit. A guest in one's home should always leave as a friend—and these generally do.

A near relative of the "open house" is "family night," when relatives and friends of employees visit the telephone office. Central office visits by school classes, service clubs, and other groups also fit in this category. Recently a modification was used with great success by one Bell company when personal invitations were issued to individuals in special groups—clergymen at one time, educators at another, and groups of labor union officials at another. These people were greatly impressed by the sincerity of the company management and the working conditions they found. Labor leaders commented afterwards that—

"It is a surprise to see your plant men working in white shirts and ties" . . . "I was impressed by general working conditions and hours worked" . . . "I have been favorably impressed by the efficient operation of your business . . ."

Demonstrating Progress

IN THE SPRING OF 1949, a new type of demonstration appeared on the Bell System scene. It was appropriately called "Looking Ahead with the Bell System," * and among its features were working units demonstrating operator toll dialing straight through to the distant telephone, automatic message accounting, and radio relay transmission. Also shown were new vacuum tubes, an advanced type of telephone, coaxial cable, synthetic quartz crystals, and the transistor. Since its initial showing at the annual Stockholders' Meeting on April 20 of that year, it has been exhibited by ten Bell System Companies in 13 major American cities.*

"Looking Ahead" was designed to do just that—to look ahead with investors, customers, and employees—by inviting selected community leaders to visit the demonstration. Ninety-seven thousand such guests and 58,000 employees have seen it at telephone company locations so far. Capable telephone men and women act as guides or narrators, creating a pleasing impression in every case. Usually, the company president or another officer talks to each group, outlining the Bell System's plans and the role of his own company in the community.

On every hand, visitors continue to comment enthusiastically. They say the demonstration is more than merely informative. Employees derive stimulus from the broad picture of the future and the part each can play in the over-all job. Stockholders acquire confidence in the growing opportunities of the business. Telephone users respond to what the future promises and the way telephone people go about the job of fulfilling those promises.

Hundreds of letters have been received by the Companies, lauding "Looking Ahead." News stories and editorials have been numerous.

In every city, government authori-

* See "Looking Ahead with the Bell System," MAGAZINE, Spring 1949.

* New York, Washington, Detroit, Lansing, Cleveland, Columbus, Boston, Philadelphia, Pittsburgh, St. Louis, Springfield, Chicago, Los Angeles.

ties were invited, quite naturally, along with other civic leaders. At Washington, Federal government representatives in many branches were guests of the telephone company. Major General S. B. Akin, Chief Signal Officer, Department of the Army, was so impressed by the exhibit that he ordered a similar one to tell the story of Signal Corps operations, and it too is a marked success.

Major Fairs

LAST SPRING, a major fair loomed on the horizon—the Chicago Lake Front Fair. The Bell System had not planned to take part, but when the Fair's director saw the "Looking Ahead" demonstration as exhibited in Chicago, he declared it "a perfect example of American free enterprise, and exactly what we need at the Fair!"

Although "Looking Ahead" had been designed for small and selected groups, it was found possible to modify it for a mass audience. At the last minute, it was decided to do so under the joint auspices of the Illinois Bell Telephone Company and the Long Lines Department of A. T. & T., and the Western Electric Company.

Agreement to participate was reached only 29 days before the Fair opened its gates. In that period, a building was constructed, guides were trained, and the exhibits were remodeled. In order to install equipment, the inside of the structure was completed before the outside. The exhibit opened on time.

THE LAKE FRONT telephone exhibit was called "The Bell System Presents . . . The Telephone of Tomorrow." Choice of demonstrations and individual exhibits was carefully evaluated in order to show convincingly how the industry has kept pace with the parade of American achievement. From "Looking Ahead," the operator toll dialing, radio relay, and automatic message accounting demonstrations were selected.

Because of their universal appeal, certain other audience participation exhibits were chosen to round out the show. These included the voice mirror, an overseas call display, test-your-hearing booths and time and weather booths. The "Telephone of Tomorrow," the new 500-type set, was displayed on a special counter.

When "Looking Ahead" was displayed in Boston, it was also televised on an hour-long program

This view is inside the telephone exhibit building at Chicago's Lake Front Fair last Summer. At the left is a display of automatic message accounting equipment, and a new type of telephone is on a counter at the right

The factors of interest that caused the Fair's director to want this telephone exhibit have been amply borne out. It was the hit of the Fair, attracting over a million persons—77 percent of all visitors. Part of the reason for this large attendance was a location near the main gate. But the chief cause is the exhibit's tremendous popular appeal that brings people back again and makes them urge their friends to see the show. One suburbanite wrote:

"Your entire exhibit was built around the idea of permitting the public to 'Touch' and 'Listen.' As we stood back and watched the reactions of the people as they entered the building, we couldn't help but feel that through your efforts, a closer bond was immediately established between strangers, as they laughingly listened on the earphones . . ."

Some of the attendants had worked on "Looking Ahead" when it was shown at the Chicago telephone building. Others were added for the Fair. All were carefully selected and trained, and the excellent job they did of representing the Bell System may be illustrated by two examples.

A well-dressed, elderly man stopped an exhibit floorman and said, "Excuse me, I know this is an unusual question, but please tell me—where do these girls and men [demonstrators] go after the Fair is over?"

The floorman explained that the employees working at the Fair would eventually go back to their regular jobs.

Pointing to a girl at the coaxial cable exhibit, the visitor inquired, "What's her regular job?"

The floorman explained she was a

service representative in the Commercial Department.

"That's marvelous," said the visitor. "These men and women seem to know all about all these exhibits and they answer questions very intelligently. I am very interested to know that you have such efficient employees . . . you see, I'm a modest shareholder of A. T. & T. stock."

Another visitor to the Fair approached a girl narrator and asked if she were a long distance operator. He said he'd never met one, and wondered if they looked like "The Voice with the Smile."

The narrator said she was not an operator; but she took him over and introduced him to a long distance operator who was then on duty at the demonstration switchboard.

Said the gentleman: "You *do* live up to your advertising."

When "Looking Ahead" was exhibited at the Texas State Fair at Dallas to 370,000 people, a Baylor University student majoring in speech was attracted by the attendants' speaking qualities. Commenting on them, he asked, "What, for example, is the telephone job of that girl?" "That girl" was, it turned out, an elevator starter.

A Historic Fair

FAIRS AND TRADE SHOWS are not new in the commercial world. Historically, fairs have existed since medieval times, when they were started at the scene of religious gatherings. But gradually the needs of the crowds attracted merchants, and trade began to appear. The last century has seen the emergence of the exposition and trade show, along with the fair.

Most Bell System Associated Companies participate in State and County Fairs. At these, and at trade shows, the telephone company takes its story out to the public. The companies participated in 105 fairs alone in 1950, with an estimated attendance at telephone exhibits of 4,150,000 people. The messages they convey follow the pattern of open houses, and vary according to the company, community, and locale.

At fairs, in particular, the crowd seeks entertainment as well as enlightenment. The fact that 77 percent of the Chicago Fair's paid attendance—or 1,321,000 people—visited the "Telephone of Tomorrow" exhibit is indicative of the Bell System's skill in blending the two elements.

It is nearly 75 years since the telephone first received public recognition at an exposition: the Philadelphia Centennial, held in the Summer of 1876. Here Alexander Graham Bell, the telephone's inventor, displayed an early model of his "speaking telephone," and here occurred the famous encounter between Bell and Dom Pedro, the Emperor of Brazil. The emperor was inspecting the exhibits, accompanied by the judges of the exposition, when he encountered Bell, whom he had known through his educational work for the deaf. Dom Pedro asked what Bell was doing there, and the latter described his invention and invited His Majesty to test it out. It was the emperor's incredulous exclamation of "My God—it talks!" which attracted the attention of the judges to what one of them later declared was the most wonderful thing he had seen in America.

Just 74 years later, the Brazilian consul at Chicago telephoned to Rio de Janeiro, Brazil, from the telephone exhibit at the Lake Front Fair, while ten hard-of-hearing children from Chicago's Alexander Graham Bell School listened in. The call was answered—oddly enough—by a man named Bell: Mr. W. G. Bell, president of the utility company which provides the telephone service there.

While that coincidence was prearranged, it is nonetheless a fact that, since the Paris Exposition of 1889, there has been a telephone exhibit at every World's Fair, to display to visitors from all the world the evidences of the progress of telephony in America.*

Scientific Museums

MUSEUMS of science and industry are another source of telephone information for crowds of people.

The basic idea behind museums is as old as man's thirst for knowledge. Over the years, museums have become storehouses of information men

* See "Some Historic Telephone Exhibits," Quarterly, July 1939.

This display in the Franklin Institute in Philadelphia is devoted to the telephone. In the foreground are shown transitors, laboratory-grown crystals, and items of Western Electric Company manufacture. The panels in the background are devoted to problems of transmission and switching

These visitors are learning about the operation of telephone relays in the Museum of Science and Industry in Chicago

wanted. Today, millions of children and grown-ups go to museums of science to learn about nature's phenomena. One of the marvels they want to know about is the telephone. For this reason, the Bell System now has major exhibits at the Museum of Science and Industry in Chicago and at the Franklin Institute in Philadelphia.

The Chicago museum is one of the most beautiful and interesting buildings of its kind in the world. It uses every type of showmanship, but is unique in that most exhibits permit audience participation to a degree not approached elsewhere. During 1949, the museum attendance was 1,666,500, with the audience divided about evenly among men, women, and children. Surveys show that 80 percent of the visitors see the Illinois Bell Telephone Company's exhibit. Through the end of July, 1950, three months after installation, a voice mirror had been used 100,568 times, while a register on the overseas exhibit showed it had been operated 49,664 times.

The telephone theme unit at the Chicago museum tells dramatically the story of universal communications. A diorama represents a typical 500-mile section of country with numerous telephone central offices and mobile transmitters. By means of lights, buildings, and moving vehicles—a train, an auto, a ship, and an airplane—use of telephone communications to reach anyone anywhere can be shown. Visitors can operate the diorama by listening to a telephone receiver. While they see these calls traced out on the diorama, they hear a synchronized story.

Other museum exhibits at Chicago include transmission, how your telephone works, new Bell Laboratories developments, hearing tests, the one-millionth Chicago telephone, Western Electric manufacture, crossbar switches, and the ever-popular "Oscar demonstration" of binaural hearing. A small theater projects Bell System sound movies, and adjoining the theater is a children's workshop where youngsters may work with various items of telephone apparatus.

Another outstanding museum is the Franklin Institute in Philadelphia. Founded in 1824, and designed to be a permanent memorial

The "Panorama of Telephone Progress" in Montreal is representative of historical displays in several telephone company headquarters

to Benjamin Franklin, it is dedicated to the promotion of the mechanic arts and the dissemination of scientific knowledge.

About 300,000 people visited the Institute in 1950, and an estimated 200,000 a year will view the Bell Telephone Company of Pennsylvania's new exhibit there, which opened experimentally last April.

The elements of the main displays are similar to those in the Chicago Museum of Science and Industry. They tell a basic research story as applied to the field of telephony.

The layout consists of a circular room where the exhibits are set in recessed niches. It is on two floor levels, from which the various units may be viewed. Upon entering the room, visitors are directed by a sign to start the tour by ascending a stairway. They then proceed clockwise around a ramp to the bottom of another stairway. At this point they may enter either a hearing-test room or continue the tour of the exhibits located on the lower floor level.

The roster of exhibits covers such topics as speech and hearing, how the telephone works, transmission and switching, how dial switching works, overseas service, calls to mobile telephones, pathways for voice and vision, cross-country operator dialing, the hearing test room, transistors, growing crystals, manufacturing dial equipment, the new handset, and microwave radio relay.

The individual displays are designed for operation by the visitors, by means of push buttons or dials,

FACE-TO-FACE CONTACTS: BELL SYSTEM

Event	Attendance 1949	Attendance 1950 Est.*
Fairs	2,900,000	4,150,000
Trade Expositions	2,100,000	2,200,000
"Open Houses," etc.	800,000	800,000
Traveling Exhibits ("Looking Ahead" and 1950 Exhibit)	76,000	97,000
Museums	1,500,000	2,000,000
Other Permanent Exhibits	—	1,000,000
Special Exhibits	—	1,500,000
Total	7,426,000	11,747,000

* Projection as of 12/15/50.

using the telephone instruments associated with the respective exhibits. Two exhibits are fully automatic and operate continuously for visitor observation. The radio relay exhibit is designed for demonstration by an attendant, who is assigned to the exhibit room at all times.

Museum telephone presentations are made clearly and comprehensively in three dimensions. Exhibits are designed to give ample opportunity for visitor participation. Utilizing light, color, motion, and various means of dramatic portrayal, such displays strive to make plain to everyone that the industrial application of science leads to the betterment of life on earth.

Several Bell System companies have historical exhibits in their headquarters building, and the Telephone Pioneers have often been the well-spring of contributions to such collections. Each year new ones are added, the latest being that of the Bell Telephone Company of Canada at Montreal. Called a "Panorama of Telephone Progress," it presents the development of the telephone by significant stages, starting with the telegraph and Bell's early models. It ends with examples of the latest achievements in telephony, some of which have not yet been put into actual plant operation.

THE BELL SYSTEM'S audio-visual information program is a teamwork undertaking. The Bell Laboratories, Western Electric, and Long Lines make significant contributions as new vistas of the art of telephony are revealed. All the Associated Companies take part, and many employees have a hand in it. The results, shown above in terms of customer attendance, are impressive.

Making possible those millions of face-to-face contacts is a constructive undertaking on a large scale, and the Bell System recognizes its opportunity—and its responsibility. For there must be a carefully balanced combination of interest and information if so many people are to gain through them a better understanding of the telephone and its operation, and perhaps, too, of telephone company problems and policies and objectives.

Foresight, Sturdy Plant, and Swift Restoration Minimize Effects of the Most Violent Storm Ever Experienced in The North-Eastern Section of the Country

Bell Companies in the East Withstand Heaviest Blow

Judson S. Bradley

THE GREAT and unexpected storm of November 25 was, the Weather Bureau reported, "the most violent of its kind ever recorded in the north-eastern quarter of the United States." And to that statement many a weary telephone man and many a doubly busy telephone girl would have said a heartfelt *Amen.*

For the past dozen years, the New England hurricane of 1938 has been the measuring rod against which all eastern storms have been tried. In the viciousness with which wind and rain and fire and tide combined to assault telephone plant, and in the number of telephones put out of order, the New England hurricane has stood unequaled. But no longer. The Autumn storm of 1950, sweeping fiercely from West Virginia across Ohio and Pennsylvania, through New Jersey and New York and the six states of New England and on beyond, has in some respects outdone it. The tide along the Atlantic Coast was higher and in some places the snow was deeper than ever before, and in one day more telephones were knocked out of service than during the earlier catastrophe.

Wind was the arch villain. Its ferocity was brutal. Over vast areas it unroofed houses or blasted them from their foundations. Barns it blew apart, water towers and silos it toppled, commercial structures it damaged wherever and however it could.

Wind alone, when of the force of that gale, is a ruthless destroyer. Accompanying it were snow and sleet and rain. They were all manifestations of weather, and which one turned up depended pretty much on geography. But all three served, in one place and another, to increase the damage and complicate the tasks of reconstruction. Combined with wind, they sired a catastrophe. Its tragedy

The tide along the Atlantic coast was the highest . . .

is mourned in hundreds of deaths. Its damages are tallied in hundreds of millions of dollars.

Wind

WIND topples trees.

Trees fall on wires and cables and break them off or bear them to the ground.

That, in brief, is the principal reason why more than 600,000 telephones were put out of service on November 25. Why calls could not go through on 3,200 toll and long distance circuits. Why 129 central offices were isolated from the rest of the Bell System wire network. Why the estimated cost of restoration will run to as much as $7,500,000.

That is the principal reason, but it isn't the only one. Not by a good deal! Snow is in the picture, too. In West Virginia and Ohio and Western Pennsylvania, more snow fell. and drifts were deeper, than ever before. Transportation of every kind collapsed. And people did what they usually do in such circumstances: they turned to the telephone, to transact their business, to give and to obtain reassurance, to take care of all the interests and necessities an emergency imposes.

Even though telephone plant in this part of the storm area suffered relatively little damage, telephone switchboards were soon attempting to handle peak loads of calls with too few operators. For blocked streets and highways stymied telephone people just as it did others. There are many tales of both men and girls whose courage and stamina overcame great obstacles to meet their obligations to the public by reporting for duty. Girls who had beer taking late tricks the night before stayed on in rest rooms or nearby

. . . and in places the snow was the deepest on record

Sleet was an enemy in the suburbs . . .

hotels, to be on hand when needed. Supervisors and former operators took up cords. Girls who were off duty reported. Plant men got out heavy construction trucks and collected operators. At some times and in some places, telephone calls were answered only on an emergency basis. But all important ones were taken care of, and it was not long before all calls were being handled.

Western Pennsylvania was fortunate in escaping major damage to outside plant. But both sleet and floods harassed parts of the Central Area, and torrential rains accompanied the gale which staggered much of the Eastern Area. Yet despite its own troubles, the Bell Telephone Company of Pennsylvania was able to send five crews to the aid of its neighbor, the New Jersey Bell Telephone Company.

"Hot" Wires

New Jersey was, proportionately, hardest hit of all the Companies affected by the storm. By the time its fury had abated, Saturday evening, 2,000 cables were damaged or broken, and 135,000 telephones were dead.

Here, as wherever trees blew down, there was an important secondary cause of damage to wire and

. . . and in the open countryside as well

cable and of the failure of telephone service. Like the telephone companies, the light and power companies in the region suffered extensive damage to their wires. Their wires were "hot," however, and when they fell across telephone lines, they were likely to inflict power burns on the telephone cables. Short circuits and arcs would melt the cable sheath, damage the wires, and admit moisture; and if the cables had withstood the gale so far, they then went out of service—pronto. Moreover, in many cases telephone men could not start the process of untangling and repairing their own plant until current had been cut off in the live power wires. Telephone and electric companies throughout the storm area recognized that they were both victims of the unpredictable forces of Nature, and coöperation among them was cordial.

In New Jersey, telephone forces 5,000 strong were on the job by daylight on Sunday morning—the day after the big blow—to tackle the biggest repair job they had ever encountered. Test Bureau forces met an avalanche of trouble reports head-on, while operators who had struggled through the storm to bear a hand faced switchboards ablaze with light —"permanent" signals caused by damaged cables.

Playing on the Bell System Team

WHAT membership in the Bell System means, to both telephone workers and telephone users, was made evident once again when, promptly on Monday morning, trucks with men and their equipment began rolling in to New Jersey from other Bell companies which had been less hard hit and could spare them: the Chesapeake and Potomac, the Ohio Bell, the Bell of Pennsylvania, and, later in the week, the New York and the Southern New England Companies. They were a welcome sight to the beleaguered New Jersey Bell men, and, because they had their tools and knew their stuff, they could be greeted in one breath and given their assignments in the next.

The storm which raised such havoc in New Jersey kept right on going into New York State, throttle wide open and whistle blowing. Actually, the New York Telephone Company took the severest beating of all, on the basis of telephones out of service: 222,000. They were, however, spread out over an area from Long Island to the Canadian border. There had long been in existence here, as in all Bell Companies, an emergency plan to meet just such a disaster; and by Sunday morning, 9,500 men—the normal Sunday roster is less than 1,000—were at work throughout the Company's three areas, battling against odds that often included snow, sleet, and freezing temperatures, to get lines back in service. By the middle of that week, all but a few were again in working order.

More than telephone plant was damaged here

That Sunday was a day that opera-
ɔrs will not soon forget, for the
raffic averaged probably 70 percent
bove normal. On the following day
n all-time record was set in New
ork City with a total of 20,087,000
lls.

rouble in New England

N Connecticut, which is served by
e Southern New England Tele-
hone Company, more than 80,000
elephones were victims of that Satur-
ay's storm, mostly along the Coast
nd in the central part of the state.
s service was brought back to nor-
al in the upper part of the state,
en were transferred to the shore
reas, and by the following Wednes-
ay night, a convoy of 30 trucks, with
eir crews, was off for New Jersey.
One of the most unusual incidents of the whole storm period was the conversion of a telephone central office from manual to dial operation, exactly as scheduled, at 7 A.M. on Sunday, November 26—the day after the gale. The event, in Wallingford, Connecticut, had long been planned, and 5,000 customers had been notified; so, while more than 1,000 telephones were out of order in the Wallingford exchange, they would be neither more nor less out of order in a dial office than in a manual office, and the event took place successfully even as repairs were being carried on throughout the town.

East and north of Connecticut lie the other five states comprising New England, the territory of the New England Telephone and Telegraph Company. It is the most easterly

A splicing team works on cable down in the snow

The Other Side of the Picture

Damage is spectacular. Broken poles and tangled wires beside the road bespeak the fury of the storm.

Restoration is encouraging. Truck convoys rolling to the scene, skilled crews working valiantly to restore service, are a reassuring sight.

Such things attract attention They make news.

But there is another side to the picture: the telephone plant which withstands the storm's assaults, the service which does not falter. Even in an emergency, they are pretty much taken for granted. And they are by far the larger part.

Let's look at this in terms of just one hard-hit Area of one telephone company, by way of making the point.

The storm put 39,000 telephones out of order there. But those telephones were 5.7 percent of all the telephones in that Area; and, because some people had extension telephones, actually only 5.25 percent of all customers were affected. Now, that is still a lot of people without service, and it is scant consolation to a man with a useless telephone to know that he is part of a small statistic. But the fact is that close to 95 out of every hundred telephones stayed in service; that for every customer who could not make a call, there were nearly 20 who could.

Incidentally, of those 39,000 telephones, better than 95 per cent—37,050—were repaired within twenty-four hours.

About 400 poles in that Area went down. But statistically they were twenty-four one-hundredths of one percent of all the telephone poles in service there. In other words, about 159,500 poles stood firm against the most violent storm of its kind ever experienced in that part of the country.

Or take, on the broader stage of the whole storm-stricken territory, the 475 telephone buildings which continued to furnish service despite the failure of their commercial power supply. Had not arrangements been made to overcome just such a situation if ever it should arise, who knows how many times greater might have been the number of telephones out of order, how many communities might have been entirely deprived of service?

Interruption to telephone service on such a scale is a serious matter. It must not be—and is not—taken lightly. But this account would be incomplete if it did not point out the brighter side of the picture.

section of the United States, and as the storm traversed it on its way out of the country, it did still further damage to the region's telephone service. When it had passed, 125,000 telephones were silent.

Thousands of feet of aerial cable had to be replaced

In Vermont, worst damaged of the New England states, the storm exhibited the characteristics of a tornado, using hit-run tactics as it struck cruelly at one point and passed another by unscathed. Twenty percent of the New England Telephone Company's telephones in that state were out. But 5,000 of the Company's men met the storm's bleak challenge with a dawn-to-dark restoration schedule, and by the middle of the following week such progress had been made in the other states which the Company serves that 360 men could be sent to the aid of their fellow workers in the Green Mountain State. Vermont took longer than the other New England states to straighten out, but the damage there too was licked by organization, materials, and skilled and loyal workers.

Mobile telephone service was important in maintaining emergency contacts

SINCE we noted earlier that 600,000 telephones were put out of service in one day—Saturday, November 25—it is appropriate to observe that more than half that number were restored within the next two days, and that by the end of the week all were again in working order, as the result of extraordinary, persistent, and well-organized efforts—except for scattered cases in New Jersey and Vermont.

Wires of the Long Lines Department, which weave a web of circuits interconnecting the nation's telephones, were likewise victims of the storm. About 675 circuits were put out of order, and most of those were restored within the next 24 hours. And at some Long Lines central offices in the stricken territory, the number of telephone calls placed was far more than on a normal day: as much as 83 percent above the average in one city.

Night work carried on by flood light speeded the restoration of service

Western Electric Plays on the Same Team

The same form of Bell System organization which makes possible the interchange of employees during times of great need also contributes mightily to another factor in the restoration of telephones to usefulness. For the Western Electric Company, whose business is the manufacture and supply of telephone apparatus and equipment, is a member of the Bell family, and, like the Operating Companies of the System, Western has only one ultimate objective: service to the telephone user. That objective it reaches through its knowledge of telephone company needs, through its great manufacturing capacity, and—additionally—through the spirit of service of its employees, which matches that of their colleagues in the Operating Companies.

When reports of damage hurtled into the Western Electric's distributing houses in the affected area, early on the morning of the storm, the first move was to line up warehousemen in preparation for rush calls for replacement equipment. As high winds continued and more and more trees went down, the rush calls came—and the big demand was for drop wire and associated line equipment. By that night, all drop wire had been shipped not only from the distributing houses but from Western's Point Breeze Works in Baltimore as well. Point Breeze started Sunday noon to make drop wire on a round-the-clock schedule, and some of it had scarcely cooled by the time it was being used to restore service in New Jersey on Monday. Within that week, Western Electric shipped 18,000,000 linear feet of drop wire. That is a big figure; but it is no less typical of Western Electric's response to the need than is its Pittsburgh House's ability to get 500 telephone sets through blizzard-blocked lines to Harrisburg in the mail car of a passenger train, or its Supplies Service organization's skill in routing five cars of poles from the south around flood areas to fast delivery on Long Island, where there was urgent need for them. Shipment of key items by air was a usual procedure. Dozens of similar instances of the dovetailing of problem and solution could be cited, such is the quick-working relationship of the Operating Telephone Companies and Western Electric in the Bell System scheme of things.

While 129 central offices were isolated for brief periods, a total of 475 telephone buildings would have been in a far more serious situation—unable to give service at all—if it had not been for emergency preparations made long since. For the commercial electric power which served those 475 buildings and normally kept the lines operating and the bells ringing, succumbed to the devastating force of the storm.

Such a situation had been foreseen, however. In 190 of the larger buildings, gasoline or diesel engine generators are part of the regular stand-by equipment. Portable engines were readily available to about 200 others. And in the remaining buildings, battery reserves had been designed to be adequate to the emergency demands made upon them.

A "power burn" may be seen in the cable just ahead of the splicer's right hand

Crews borrowed from other Bell companies came to the help of their New Jersey colleagues both aboard their own vehicles and by train

The new radio relay systems also gave striking evidence of their reliability. Between Boston and Chicago, six stations were among those without commercial power, but automatic emergency generators took up the load and there was no failure of service.*

Mobile radio telephone units again proved their value. One was dispatched to break the isolation of a small New Jersey community, for instance, but surrounding hills were found to be blanketing its signals. The engineers then drove it to the top of the highest hill, set up shop at one end of an open-wire span, and provided emergency service until a cable was repaired late that afternoon. Elsewhere, other radio units were rushed to several hospitals, where they relayed summonses for doctors and nurses and blood donors.

* See page 225.

And in Vermont, where difficulties were of the severest, several mobile radio units were used to furnish service until wire circuits could be re-established, while the augmented repair forces in the state also used some units for supervisory and dispatching purposes.

The Three Ms

IMPLICIT in every page of this 20th-century saga is not only the skill but the loyalty and devotion of the men and women who furnish our telephone service day in and day out and who rise selflessly to the needs which some extraordinary situation imposes upon them.

There are three Ms which have a peculiar significance in such gigantic tasks as this.

Men—meaning the men and women of the Bell System—is the first M. Another M is for Materials, which are supplied quickly and in the necessary quantities by the Western Electric Company. The third M stands for Money. It takes but an instant's reflection to realize that only a financially strong and healthy system could face up to an emergency of such dimensions.

That particular emergency is over. The calls flow smoothly again. So it is not inappropriate to close this narrative with a jest—a jest which, often repeated in the harried days after the storm, still has its point. Somebody asked a Western Electric employee at one of the distributing houses, as things quieted down, what the supply job had been like. "It had us jumpin' for a while," he answered, "but all in all it was a pretty normal emergency."

In that jest lies a world of truth.

Western Electric merchandising supervisors give the go-ahead to a load of telephone plant items headed for the storm area

The A. T. & T. Company's Annual "Telephone Statistics Of the World" Summarizes Much Information about the Telephones in Service on All Continents

Where the World's Telephones Are

Elizabeth Wrenshall

THERE WERE approximately 70,300,000 telephones in service in the world on January 1, 1950.

We in this country have available to us, on the average, one telephone for every four persons; the world outside the United States has one for every 74 persons.

Pertinent data about the distribution of telephones by countries are published in *Telephone Statistics of the World*, the most recent issue of which has just been released. This survey is compiled annually by the Chief Statistician's Division of the American Telephone and Telegraph Company. Its statistics, supplied by some 300 government administrations or telephone operating companies throughout the world, present the only authoritative picture of total global telephone distribution.

Although the ultimate goal of being able to talk with any person at any time, wherever he may be, and at a reasonable cost, is still somewhat short of attainment, astonishing progress has been made toward its realization. The "electrical toy" which, three-quarters of a century ago, was judged to be interesting but of no practical value, is now regarded throughout the civilized world as being a commonplace necessity. Today, approximately 96 percent of the world's 70,300,000 telephones may potentially be connected with those of the Bell System, thereby bringing closer to us even the most remote of the habitable parts of the earth.

Not only are our places of business and residence interconnected, but we may speak from speeding vessels, motor cars, and trains.

Emerson could not foresee our efficient present-day system of communication, but he described it well:

"We had letters to send. Couriers could not go fast enough, nor

TELEPHONES IN CONTINENTAL AREAS
January 1, 1950 [a]

Continental Area	Total Telephones			Privately Owned		Automatic (Dial)		Connecting with Bell System	
	Number	Per Cent of Total World	Per 100 Population	Number	Per Cent of Total Tels.	Number	Per Cent of Total Tels.	Number	Per Cent of Total Tels.
North America	43,424,100	61.8	26.5	43,078,900	99.2	29,114,100	67.0	43,406,200	100 [b]
Middle America	523,900	0.7	1.0	485,300	92.6	349,200	66.7	508,300	97.0
South America	1,657,000	2.4	1.5	845,500	51.0	1,214,700	73.3	1,535,100	92.6
Americas	45,605,000	64.9	14.1	44,409,700	97.4	30,678,000	67.3	45,449,600	99.7
Europe	20,000,000	28.4	3.3	2,896,700	14.5	12,900,000	64.5	17,960,000	89.8
Africa	805,600	1.1	0.4	12,400	1.5	525,400	65.2	668,400	83.0
Asia	2,367,000	3.4	0.2	176,200	7.4	978,000	41.3	1,564,000	66.1
Oceania	1,522,400	2.2	11.3	100,000	6.6	948,600	62.3	1,508,000	99.1
World	70,300,000	100.0	3.0	47,595,000	67.7	46,030,000	65.5	67,150,000	95.5

[a] Partly estimated; data reported as of other dates have been adjusted to January 1, 1950.
[b] Less than 0.05 per cent do not connect.

far enough; broke their wagons, foundered their horses; bad roads in Spring, snowdrifts in Winter, heat in Summer—could not get their horses out of a walk. But we found that the air and the earth were full of electricity, and always going our way, just the way we wanted to send. *Would he take a message?* Just as lief as not; had nothing else to do; would take it in no time."

Telephones Considered by Continental Areas

As may be seen in an accompanying table, 61.8 percent of the total number of telephones in the world are located on the continent of North America. Ninety-four percent of North America's telephones are in the United States. The ratio of telephones to population obtaining on this continent, 26.5 telephones per 100 inhabitants, is eight times that for Europe, which continent ranks second in telephone density. The city of New York alone has more telephones than have South and Middle America combined.

MIDDLE AMERICA

About one percent of the Western Hemisphere's telephones are located in Middle America. Bermuda has the highest telephone development within this grouping, with 15.6 telephones per 100 population. Mexico ranks first in respect to number of telephones in service, with 273,555. More than half of Mexico's telephones are located in its capital city.

SOUTH AMERICA

Argentina leads in number of telephones in South America, with 717,000. Of that number, 72 percent are in the city of Buenos Aires. Brazil, where telephony was introduced as early as 1881, ranks second in respect to absolute numbers, with 38 percent of its total in Rio de Janeiro. Chile occupies third place; approximately 55 per cent of that country's telephones are grouped in its capital city, Santiago.

EUROPE

In considering total telephones by continents, Europe ranks second in respect to both absolute number and telephone density. The United Kingdom has more than twice as many telephones as has any other European country, but ranks fifth in telephone density among the large countries of Europe. Nearly 30 percent of the United Kingdom's telephones serve Greater London.

In point of absolute size, Germany's telephone system is Europe's second-largest. France's system ranks third, with 26 percent of its telephones in Paris. Sweden's is fourth in size (22 percent in Stockholm). The telephone system in the U.S.S.R. ranks fifth, that of Italy sixth (19 percent in Rome).

Considering the number of telephones in proportion to population in Europe's telephonically important countries, the first five are, respectively, Sweden (22.8), Switzerland (18.2), Denmark (15.8), Norway (13.3), and United Kingdom (10.2).

Europe and the Americas, in the aggregate, have 93 percent of the world's telephones.

AFRICA

805,600 telephones were reported to be in service in the continent of Africa, nearly 52 percent of them being in its southern-most country, the Union of South Africa. The regions on the north coast, i.e., Algeria, Egypt, Morocco and Tunisia, account for 35 percent of the total. This leaves only 104,728 telephones, or about the same number as in Richmond, Va., to serve all the rest of Africa's large territory.

ASIA

Asia, with its vast expanse of land and its enormous population (more than half of the world's inhabitants), has approximately the same number of telephones as those in service in the two cities of Chicago and Detroit combined; and of that number, 71 percent are in Japan. There is but one telephone, on the average, available to every 2600 people in India, one to every 1840 in China. In Asia, the concentration of telephones in principal cities is high: 44 percent of India's are in the two cities of Bombay and Calcutta, 16 percent of Japan's in Tokyo, 37 percent of China's in Shanghai. In Thailand, 100 percent of the telephones are located in the city of Bangkok.

Israel leads Asia's countries in regard to telephone density with 2.1 telephones per 100 population, followed by Japan with 2.0.

OCEANIA

Australia has 1,066,385 telephones, which is 70 percent of the total number in service in Oceania. Nearly half of Australia's telephones are located in the two cities of Melbourne and Sydney.

The telephone system of New Zealand is second in size among Oceania's countries. Telephone distribution in New Zealand is relatively even. Approximately 40 percent of the total are in the four largest cities. These cities in the aggregate have a telephone development of 18.7. The balance of the

Through overseas radio telephone transmitting stations such as this one at Lawrenceville, N. J., calls can reach 85 foreign countries or areas

country has a development of 18 telephones per 100 of the population.

Telephones in Large Countries

As of January 1, 1950, there were ten countries in the world which had more than one million telephones each. These, in order according to the number of telephones in their systems, were: the United States, the United Kingdom, Canada, Germany, France, Japan, Sweden, U.S.S.R., Italy, and Australia.

THE UNITED STATES

On January 1, 1950, there were 40,709,398 telephones—about 58 percent of all those in the world—in service in the United States, operated entirely under private ownership. The use of the telephone in this country has kept pace with the growth in population. In the decade from 1940 to 1950, notably, the absolute increase in the number of telephones and that in our population both approximated 19 million. We had 13.5 million more telephones at the beginning of 1950 than we had on VJ day. During the year 1949 alone we added more than 2.5 million telephones, or more than were in service in all of France at the end of that year.

Not only are more telephones being used, but they are being used more often: 355.1 telephone calls per capita were made in this country in 1949, as compared with 254.6 for the year 1944. The calls are lasting for a longer time, too. The average duration of a toll call, as reported by the Long Lines Department of American Telephone and Telegraph Company, has increased by approximately half a minute during the past five-year period.

THE UNITED KINGDOM

The world's second-largest telephone system, that of the United Kingdom, reported 5,177,370 telephones as of March 31, 1950. This number represents 5,122,369 telephones operated by the British Post Office, and 55,001 operated by the telephone departments of the city of Hull and of the islands of Guernsey and Jersey. In respect to telephone density, the United Kingdom ranks ninth among the large countries of the world. The British telephone system, instituted under private ownership in 1878, was subsequently purchased by the government and is operated by the General Post Office. The United Kingdom is served by the world's largest government-owned telephone system.

CANADA

Canada's telephone system occupies third place in respect to both absolute numbers and telephones per 100 of the population. More than four-fifths of the total number of telephones in service are operated under private ownership. Canada's two largest cities, Montreal and Toronto, together contain 27 percent of the Dominion's telephones.

GERMANY

Germany ranks fourth in point of absolute number of telephones in service. Approximately 88 percent of the total are in Western Germany, which has a development of 4.4 telephones per 100 population. The telephone development of Eastern Germany plus Berlin is 1.4. Before World War II, Germany's telephone system was the largest outside the United States. It is entirely government-owned.

FRANCE

Telephone service was initiated in France in 1879 under private ownership. The government purchased the system in 1889, and has continued to operate it since that time under the Ministry of Posts, Telegraphs, and Telephones. As compared with the other telephone systems of the world, that of France ranks fifth in number of telephones in service. It ranks thirteenth in respect to telephone density, when compared in this respect with the world's large countries.

JAPAN

Japan, with 2.0 telephones per 100 of the population, has the sixth largest system in the world, wholly government-owned.

SWEDEN

Sweden, with 1,593,522 telephones in service, is second only to the United States in respect to telephone density (22.8 telephones per 100 of the population). In Sweden, as in so many other countries, telephony was introduced through private initiative. The government, which later acquired the private systems, today operates all but 0.1 percent of Sweden's telephones. The city of Stockholm has 22 percent of the total number in service. This city, with 46.9 telephones per 100 of its population, occupies third place among large cities of the world in respect to telephone development.

U.S.S.R.

The telephone system in the U.S.S.R. ranks eighth in size. The estimated 1,500,000 total of telephones in service results in a telephone development of 0.7.

ITALY

The telephone service in Italy is operated by five concessionary companies, one in each of the five zones into which the country has been divided for this purpose. Each company operates local and toll service within its zone. The government operates interconnecting long distance service throughout the country. Italy ranks ninth among the countries of the world in respect to absolute number of telephones, with 1,118,685. More than one-third of Italy's telephones are located in its two largest cities, Rome and Milan.

AUSTRALIA

The Commonwealth of Australia, which embraces almost as much land area as does continental United States, reported 1,066,385 telephones as of January 1, 1950. Australia's telephone development is relatively high (13.2 telephones per 100 population), although it ranks third in this respect among Oceania's countries.

Cities

New York cannot boast of having as many telephones per 100 of its population as have some other metropolitan areas, but in absolute number of telephones it firmly maintains leadership, with 2,956,832. Only one *country*, other than the United States, has more telephones than are in service in the city of New York. In 1879, a single card bearing 252 names comprised the New York telephone directory. In July, 1949, one million copies of the Manhattan directory were printed, listing 672,100 names on 1,644 pages.

Greater London ranks second among the world's cities in point of number of telephones in service with 1,526,548; Chicago ranks third (1,495,900); Detroit fourth (828,795); Los Angeles fifth (827,582).

Telephone density in large cities is at its greatest in Washington, D. C., with 58.8 per 100 inhabitants. San Francisco, which for some years led the other cities of the world in this respect, is second with 54.5, and Stockholm is third with 46.9.

More than 25 large cities in the United States have a telephone density greater than 40 per 100 of the population.

People in rural areas have learned to appreciate and to demand good telephone service. Since the war, there has been an increase in farm telephones of approximately 50 per cent in the United States. In most countries, a large proportion of the telephones are concentrated within their metropolitan areas, whereas only some seven per cent of this country's telephones serve the city of New York, for example. Localities in the United States having less than 50,000 population in the aggregate are served by more than three and one-half times the number of telephones in all of the Western Hemisphere outside the United States. More than two-fifths of our telephones serve places with less than 50,000 population.

(Statistical tables on pages 258–267)

TELEPHONES IN COUNTRIES OF THE WORLD

January 1, 1950

Country	Total Telephones		Ownership		Automatic (Dial)		Connecting with Bell System	
	Number	Per 100 Population	Government	Private	Number	Per Cent of Total Tels.	Number	Per Cent of Total Tels.
NORTH AMERICA:								
Alaska	14,618	11.2	67	14,551	4,150	28.4	14,618	100
Canada (1)	2,700,000*	19.6	345,000*	2,355,000*	1,530,800*	56.7	2,692,000*	99.7
Greenland	0	—	—	—	—	—	—	—
St. Pierre and Miquelon	100	2.0	100	—	0	—	0	—
United States	40,709,398	27.1	—	40,709,398	27,579,158	67.7	40,699,620	100(2)
MIDDLE AMERICA:								
Bahamas	3,400	4.5	3,400	—	3,400	100	3,400	100
Barbados	3,900	2.0	—	3,900	3,698	94.8	3,900	100
Bermuda (3)	5,600	15.6	—	5,600	5,600	100	5,600	100
British Honduras	655	1.0	655	—	0	—	0	—
Canal Zone (4)	6,141	7.7	6,141	—	6,141	100	6,141	100
Costa Rica	8,000*	0.9	200*	7,800*	0	—	0	—
Cuba	113,718	2.1	518	113,200	95,027	83.6	113,718	100
Dominican Republic	5,946	0.3	146	5,800	4,167	70.1	5,946	100
El Salvador	6,500*	0.3	2,200*	4,300*	0	—	6,500*	100
Guadeloupe	772	0.3	772	—	0	—	0	—
Guatemala	3,925	0.1	3,925	—	3,575	91.1	3,925	100
Haiti	3,809	0.1	3,809	—	3,355	88.1	2,419	63.5
Honduras	2,747	0.2	2,747	—	1,354	49.3	2,747	100
Jamaica	12,248	0.9	—	12,248	11,720	95.7	12,248	100
Leeward Islands	850	0.8	850	—	0	—	850	100
Martinique	1,666	0.6	1,666	—	0	—	0	—
Mexico	273,555	1.1	920	272,635	181,096	66.2	273,555	100
Netherlands' Antilles	2,600*	1.9	2,600*	—	2,200*	84.6	2,000*	76.9
Nicaragua	2,609	0.2	2,609	—	0	—	2,609	100
Panama	11,800	1.5	—	11,800	0	—	11,800	100
Puerto Rico	37,210	1.7	2,460	34,750	19,473	52.3	37,210	100
Trinidad and Tobago	13,546	2.1	—	13,546	8,931	65.9	13,546	100
Virgin Islands	1,000*	3.7	1,000*	—	0	—	1	0.1
Windward Islands	1,961	0.7	1,961	—	0	—	500	25.5

SOUTH AMERICA:								
Argentina	717,000	4.4	647,302	69,698	535,000*	74.6	680,000*	94.8
Bolivia	7,900	0.2	—	7,900	7,450	94.3	7,000*	88.6
Brazil	517,000	1.0	1,500	515,500	390,000*	75.4	464,500*	89.8
British Guiana	3,160	0.8	3,160	—	175	5.5	3,160	100
Chile	131,344	2.3	—	131,344	87,607	66.7	131,344	100
Colombia	76,729	0.7	61,652	15,077	36,000*	46.9	60,000*	78.2
Ecuador	8,791	0.2	7,591	1,200	1,000	11.4	1,000	11.4
Falkland Islands	240	8.6	240	—	0	—	0	—
French Guiana	170	0.6	170	—	0	—	0	—
Paraguay	5,200	0.4	5,200	—	4,500*	86.5	4,400*	84.6
Peru	44,400	0.5	—	44,400	36,025	81.1	38,800	87.4
Surinam	1,710	0.8	1,710	—	0	—	1,500	87.7
Uruguay	84,100	3.6	83,022	1,078	61,548	73.2	84,100	100
Venezuela	59,300	1.3	—	59,300	55,442	93.5	59,300	100
EUROPE:								
Albania	1,200	0.1	1,200	—	0	—	0	—
Andorra	50	1.0	50	—	0	—	0	—
Austria	371,780	5.3	371,780	—	287,243	77.3	0	—
Belgium	649,555	7.5	649,555	—	484,364	74.6	649,555	100
Bulgaria	57,000*	0.8	57,000*	—	24,000*	42.1	0	—
Czechoslovakia	380,000*	3.1	380,000*	—	225,000*	59.2	225,000*	59.2
Denmark	680,703	15.8	34,287	646,416	276,512	40.6	680,703	100
Finland	313,975	7.7	38,278	275,697	169,210	53.9	313,975	100
France	2,318,673	5.6	2,318,673	—	1,411,678	60.9	2,318,673	100
Germany, Eastern, and Berlin	300,000*	1.4	300,000*	—	200,000*	66.7	200,000*	66.7
Germany, Western	2,112,728	4.4	2,112,728	—	1,062,012	50.3	2,112,728	100
Gibraltar	1,296	5.9	1,296	—	1,176	90.7	1,296	100
Greece	75,947	1.0	—	75,947	72,000*	94.8	75,947	100
Hungary	115,000*	1.2	115,000*	—	85,000*	73.9	85,000*	73.9
Iceland	19,600	13.9	19,600	—	12,533	63.9	19,600	100
Ireland	73,431	2.5	73,431	—	46,279	63.0	73,431	100

* Partly estimated.
(1) Including Newfoundland.
(2) Less than 0.03 per cent do not connect.

† Less than 0.1.
(3) June 30, 1950.
(4) Excluding telephone systems of the U. S. Military Forces; June 30, 1949.

TELEPHONES IN COUNTRIES OF THE WORLD—Continued

Country	Total Telephones: Number	Total Telephones: Per 100 Population	Ownership: Government	Ownership: Private	Automatic (Dial): Number	Automatic (Dial): Per Cent of Total Tels.	Connecting with Bell System: Number	Connecting with Bell System: Per Cent of Total Tels.
EUROPE:—*Continued.*								
Italy	1,118,685	2.4		1,118,685	1,015,105	90.7	989,649	88.5
Liechtenstein	1,642	12.6	1,642	—	0	—	1,642	100
Luxemburg	21,971	7.6	21,971	—	15,779	71.8	21,971	100
Malta and Gozo (5)	6,452	2.1	6,452	—	0	—	5,414	83.9
Monaco	2,665	14.0	2,665	—	2,342	87.9	2,405	90.2
Netherlands	692,412	6.9	692,412	—	615,498	88.9	692,412	100
Norway (6)	430,881	13.3	357,647	73,234	249,122	57.8	430,881	100
Poland	225,000*	0.9	225,000*	—	150,000*	66.7	150,000*	66.7
Portugal	132,300	1.5	39,244	93,056	66,376	50.2	131,126	99.1
Romania	135,000*	0.8	135,000*	—	100,000*	74.1	80,000*	59.3
San Marino	100*	0.8	100*	—	0	—	0	—
Spain	606,066	2.2	17,481	588,585	454,400	75.0	606,066	100
Sweden	1,593,522	22.8	1,591,473	2,049	985,708	61.9	1,591,473	99.9
Switzerland	845,471	18.2	845,471	—	808,644	95.6	845,471	100
Trieste	25,000*	6.9	2,000*	23,000*	20,000*	80.0	20,000*	80.0
U.S.S.R. (7)	1,500,000*	0.7	1,500,000*	—	400,000*	26.7	500,000*	33.3
United Kingdom (5)	5,177,370	10.2	5,177,370	—	3,650,429	70.5	5,177,370	100
Yugoslavia	80,000*	0.5	80,000*	—	48,000*	60.0	20,000*	25.0
AFRICA:								
Algeria	90,601	1.0	90,601	—	64,088	70.7	73,000*	80.6
Anglo-Egyptian Sudan	6,000*	†	6,000*	—	3,200*	53.3	3,800*	63.3
Belgian Congo	4,537	†	4,537	—	2,531	55.8	1,200	26.4
British East Africa	16,517	†	16,517	—	11,640	70.5	12,785	77.4
British South Africa	24,200	0.3	24,200	—	17,200	71.1	22,700	93.8
British Southwest Africa	3,780	1.2	3,780	—	1,624	43.0	3,397	89.9
British West Africa	14,621	†	14,621	—	978	6.7	0	—
Comoro Archipelago	0	—	—	—	—	—	—	—
Egypt	106,000*	0.5	106,000*	—	70,000*	66.0	106,000*	100
Eritrea	2,400*	0.2	2,400*	—	1,000*	41.7	0	—
Ethiopia	1,800*	†	1,800*	—	1,500*	83.3	0	—
French Cameroon	800*	0.3	800*	—	0	—	0	—

French Somaliland	296	0.7	296	—	0	—	0	—
French Togo	450	†	450	—	0	—	0	—
French West Africa	11,528	†	11,528	—	3,500*	30.4	0	—
Libya	6,000*	0.6	6,000*	—	5,000*	83.3	0	—
Liberia	0	—	—	—	—	—	—	—
Madagascar	5,119	0.1	5,119	—	0	—	0	—
Mauritius	4,200*	0.9	4,200*	—	0	—	0	—
Morocco	58,022	0.5	45,821	12,201	40,326	69.5	53,140	91.6
Portuguese Africa	6,007	†	6,007	—	130	2.2	0	—
Reunion	2,000*	0.8	2,000*	—	0	—	0	—
St. Helena	87	1.7	87	—	0	—	0	—
Seychelles	67	0.2	67	—	0	—	0	—
Somalia	300*	†	300*	—	0	—	0	—
Somaliland Protectorate	138	†	138	—	0	—	0	—
Spanish Guinea	238	0.1	—	238	0	—	0	—
Spanish Sahara	0	—	—	—	—	—	—	—
Tunisia	23,422	0.7	23,422	—	13,665	58.3	23,422	100
Union of South Africa	415,518	3.4	415,518	—	288,976	69.5	369,000*	88.8
ASIA:								
Aden, Colony of	1,216	1.5	1,216	—	1,216	100	0	—
Afghanistan	4,000*	†	4,000*	—	250	6.3	0	—
Bahrain	500*	0.4	500*	—	0	—	100*	20.0
Brunei	60	0.1	60	—	0	—	0	—
Burma	5,000*	†	5,000*	—	1,000*	20.0	0	—
Ceylon	15,839	0.2	14,884	955	13,549	85.5	0	—
China	250,000*	†	156,000*	94,000*	175,000*	70.0	90,000*	36.0
Cyprus	4,626	1.0	—	4,626	0	—	0	—
French India	76	†	76	—	76	100	0	—
French Indo-China	5,993	†	5,993	—	2,190	36.5	0	—
Hong Kong (6)	24,729	1.2	—	24,729	24,729	100	24,729	100
India (8)	128,911	†	127,249	1,662	54,000*	41.9	110,235	85.5
Indonesia	35,750	†	35,750	—	769	2.2	10,770	30.1
Iran	21,435	0.2	3,126	18,309	8,625	40.2	9,126	42.6
Iraq	16,249	0.3	16,249	—	11,213	69.0	0	—
Israel	24,686	2.1	24,686	—	21,371	86.6	24,686	100

* Partly estimated.
(5) March 31, 1950.
(6) June 30, 1949.

† Less than 0.1.
(7) Including all Asiatic territory of the U.S.S.R.
(8) March 31, 1949.

TELEPHONES IN COUNTRIES OF THE WORLD—Continued

Country	Total Telephones		Ownership		Automatic (Dial)		Connecting with Bell System	
	Number	Per 100 Population	Government	Private	Number	Per Cent of Total Tels.	Number	Per Cent of Total Tels.
ASIA—Continued								
Japan (5)	1,681,279	2.0	1,681,279	—	563,334	33.5	1,300,000*	77.3
Jordan	3,829	0.3	3,829	—	1,693	44.2	0	—
Korea	75,000*	0.3	75,000*	—	25,000*	33.3	20,000*	26.7
Lebanon	13,300*	1.1	13,300*	—	0	—	0	—
Malaya	20,362	0.4	20,362	—	6,846	33.6	0	—
North Borneo	481	0.1	481	—	110	22.9	0	—
Pakistan	17,445	†	17,445	—	8,718	50.0	17,445	100
Philippine Republic	17,968	†	—	15,968	12,102	75.8	13,724	85.9
Portuguese Asia	1,577	0.2	1,577	—	1,400	88.8	0	—
Sarawak	713	0.1	713	—	0	—	0	—
Saudi Arabia	3,000*	†	3,000*	—	0	—	0	—
Singapore	15,736	1.6	—	15,736	15,736	100	0	—
Syria	9,198	0.3	9,198	—	2,500	27.2	0	—
Thailand	5,800*	†	5,800*	—	5,800*	100	0	—
Turkey	58,169	0.3	58,169	—	49,862	85.7	0	—
Other Places	100*	†	100*	—	0	—	0	—
OCEANIA:								
American Samoa	289	1.6	289	—	289	100	0	—
Australia	1,066,385	13.2	1,066,385	—	651,561	61.1	1,066,385	100
Fiji	2,448	0.9	2,448	—	0	—	0	—
French Oceania	2,014	2.0	2,014	—	0	—	0	—
Hawaii	100,062	19.1	—	100,062	93,427	93.4	100,062	100
New Zealand (5)	348,539	18.2	348,539	—	204,701	58.7	346,737	99.5
Pacific Islands (British)	400	0.2	400	—	0	—	0	—
Papua-New Guinea	1,520	0.1	1,520	—	0	—	1,074	70.7
Portuguese Timor	235	†	235	—	0	—	0	—
South Seas Mandate (U. S.)	5,500*	3.9	5,500*	—	2,800	50.9	0	—
Western New Guinea	500*	0.1	500*	—	0	—	0	—
Western Samoa	326	0.4	326	—	0	—	0	—

* Partly estimated.
(5) March 31, 1950.

† Less than 0.1.

TELEPHONE DEVELOPMENT OF LARGE CITIES
January 1, 1950

Data relate in general to exchange or zone areas of the cities served. Usually such areas are larger than the corporate areas.

Country and City (or Exchange Area)	Estimated Population (In Thousands)	Number of Telephones	Telephones per 100 Population
Algeria:			
Algiers	320	31,872	10.0
Bona	103	2,444	2.4
Constantine	120	3,785	3.2
Oran	256	12,229	4.8
Argentina:			
Buenos Aires	4,300	519,070	12.1
Australia:			
Adelaide	406	58,578	14.4
Brisbane	424	66,947	15.8
Hobart	81	12,492	15.4
Melbourne	1,290	228,544	17.7
Newcastle	134	12,303	9.2
Perth	290	38,421	13.2
Sydney	1,571	266,553	17.0
Austria:			
Graz	225	19,813	8.8
Vienna	1,550	201,214	13.0
Belgium:			
Antwerp	577	64,613	11.2
Brussels	933	211,886	22.7
Charleroi	275	26,615	9.7
Ghent	218	24,254	11.1
Liége	366	44,175	12.1
Verviers	77	14,532	18.9
Brazil:			
Belo Horizonte	300	11,165	3.7
Pôrto Alegre	321	17,772	5.5
Rio de Janeiro	2,325	198,711	8.5
Santos	230	12,904	5.6
São Paulo	1,840	106,649	5.8
Canada:			
Calgary	120	36,742	30.6
Edmonton	140	33,465	23.9
Halifax	118	34,787	29.5
Hamilton	201	62,209	30.9
London	115	34,944	30.4
Montreal	1,318	361,728	27.4
Ottawa	267	81,859	30.7
Quebec	210	53,556	25.5
Toronto	915	371,764	40.6
Vancouver	426	129,096	30.3
Victoria	99	30,628	30.9
Windsor	152	40,434	26.7
Winnipeg	368	88,150	24.0
Chile:			
Santiago	1,162	72,574	6.2
Valparaiso	183	9,567	5.2
Cuba:			
Havana	924	79,464	8.6
Denmark:			
Aalborg	65	14,762	22.7
Aarhus	114	25,422	22.3
Copenhagen	972	314,351	32.3
Odense	99	19,201	19.4
Finland:			
Helsinki	388	86,236	22.2
Tampere	98	9,729	9.9
Turku	103	13,237	12.9
France:			
Bordeaux	255	34,358	13.5
Le Havre	130	12,306	9.5
Lille	211	22,697	10.8
Lyon	547	64,801	11.8
Marseille	640	58,889	9.2
Nantes	202	17,150	8.5
Nice	213	22,444	10.5
Paris	2,760	610,270	22.1
Roubaix	180	19,813	11.0
St. Etienne	180	13,846	7.7
Strasbourg	178	18,445	10.4
Toulouse	266	18,722	7.0
Germany:			
Berlin	3,308	100,377	3.0
Bremen	351	36,450	10.4
Cologne	593	48,687	8.2
Düsseldorf	495	49,054	9.9
Essen	600	24,014	4.0
Frankfort-on-Main	619	59,469	9.6
Hamburg-Altona	1,578	166,137	10.5
Hanover	486	33,425	6.9
Munich	857	69,246	8.1
Nuremberg	522	32,616	6.2
Stuttgart	627	43,328	6.9
Wiesbaden	218	15,717	7.2
Hawaii:			
Honolulu	238	71,186	29.9
Iceland:			
Reykjavik	57	11,696	20.5
India: (1)			
Bombay	3,700	29,473	0.8
Calcutta	5,900	27,824	0.5
Indonesia:			
Bandoeng	692	4,104	0.6

(1) March 31, 1949.

TELEPHONE DEVELOPMENT OF LARGE CITIES—Continued

Country and City (or Exchange Area)	Estimated Population (In Thousands)	Number of Telephones	Telephones per 100 Population
IRAN:			
Teheran	750	9,126	1.2
IRAQ:			
Baghdad	567	10,003	1.8
IRELAND:			
Cork	76	4,118	5.4
Dublin	528	42,161	8.0
ISRAEL:			
Jerusalem	103	5,036	4.9
Tel Aviv and Jaffa	307	9,379	3.1
ITALY:			
Bari	226	6,036	2.7
Bologna	292	23,763	8.1
Catania	292	8,289	2.8
Florence	322	36,082	11.2
Genoa	377	56,325	14.9
Milan	1,274	213,281	16.7
Naples	950	34,348	3.6
Palermo	492	13,018	2.6
Rome	1,553	214,548	13.8
Turin	713	82,530	11.6
Venice	197	16,496	8.4
JAMAICA:			
Kingston	266	10,133	3.8
JAPAN: (2)			
Fukuoka	385	15,641	4.1
Hakodate	228	10,454	4.6
Hiroshima	258	8,513	3.3
Kanazawa	253	13,496	5.3
Kobe	777	25,795	3.3
Kyoto	1,095	59,306	5.4
Nagoya	1,004	39,773	4.0
Osaka	1,934	105,900	5.5
Otaru	178	9,758	5.5
Sapporo	289	13,786	4.8
Tokio	6,110	263,163	4.3
Yokohama	931	25,029	2.7
MEXICO:			
Guadalajara	300	12,289	4.1
Mexico, D. F.	2,107	143,173	6.8
Monterrey	262	13,881	5.3
Puebla	175	9,975	5.7
MOROCCO:			
Casablanca	550	10,158	1.8
Rapat	165	4,881	3.0
Tetuan	80	3,209	4.0
NETHERLANDS:			
Amsterdam	836	94,220	11.3
Arnhem	103	10,202	9.9
NETHERLANDS (continued):			
Eindhoven	141	9,165	6.5
Enschede	107	6,486	6.1
Groningen	148	15,337	10.4
Haarlem	206	20,926	10.2
The Hague	618	84,218	13.6
Leiden	105	10,466	10.0
Nijmegen	117	8,274	7.1
Rotterdam	749	68,862	9.2
Tilburg	120	7,069	5.9
Utrecht	212	20,992	9.9
NEW ZEALAND: (2)			
Auckland	300	47,717	15.9
Christchurch	171	26,685	15.6
Dunedin	88	18,101	20.6
Wellington	195	48,530	24.9
NORWAY: (3)			
Bergen	114	21,368	18.7
Oslo	428	110,769	25.9
Stavanger	51	9,570	18.8
Trondheim	58	12,451	21.5
PAKISTAN:			
Karachi	1,000	5,544	0.6
PERU:			
Lima	720	31,460	4.4
PHILLIPINE REPUBLIC:			
Manila	1,043	12,102	1.2
PORTUGAL:			
Lisbon	821	58,450	7.1
Oporto	335	20,574	6.1
PUERTO RICO:			
San Juan	223	17,013	7.6
SPAIN:			
Barcelona	1,285	91,796	7.1
Bilbao	234	20,753	8.9
Madrid	1,470	144,677	9.8
Seville	405	16,536	4.1
Valencia	540	22,718	4.2
Zaragoza	272	13,366	4.9
SWEDEN:			
Borås	57	15,282	26.8
Eskilstuna	53	11,855	22.4
Göteborg	349	114,994	32.9
Hälsingborg	71	18,035	25.4
Linköping	53	13,906	26.2
Malmö	189	54,113	28.6
Norrköping	84	21,073	25.1

(2) March 31, 1950.
(3) June 30, 1949.

TELEPHONE DEVELOPMENT OF LARGE CITIES—Continued

Country and City (or Exchange Area)	Estimated Population (In Thousands)	Number of Telephones	Telephones per 100 Population
SWEDEN (continued):			
Örebro	66	19,866	30.1
Stockholm	734	344,315	46.9
Uppsala	62	18,373	29.6
Västerås	58	14,753	25.4
SWITZERLAND:			
Basel	182	70,698	38.8
Bern	143	60,238	42.1
Geneva	148	54,092	36.5
Lausanne	106	35,001	33.0
Lucerne	60	21,786	36.3
St. Gallen	67	17,782	26.5
Winterthur	66	13,213	20.0
Zurich	385	133,016	34.5
TRIESTE:			
Trieste	275	21,053	7.7
TRINIDAD AND TOBAGO:			
Port of Spain	103	8,313	8.1
TUNISIA:			
Tunis	625	13,665	2.2
TURKEY:			
Ankara	230	12,372	5.4
Istanbul	870	26,420	3.0
UNION OF SOUTH AFRICA:			
Bloemfontein	91	6,359	7.0
Cape Town	524	56,395	10.8
Durban	417	40,480	9.7
East London	87	7,050	8.1
Germiston	152	5,137	3.4
Johannesburg	865	101,013	11.7
Kimberley	62	2,731	4.4
Pietermaritzburg	69	7,162	10.4
Port Elizabeth	164	14,013	8.5
Pretoria	287	29,734	10.4
UNITED KINGDOM:			
Belfast	452	33,600	7.4
Birmingham	1,321	112,070	8.5
Bradford	289	30,100	10.4
Bristol	437	50,495	11.6
Cardiff	251	22,617	9.0
Coventry	253	20,870	8.2
Edinburgh	488	72,828	14.9
Glasgow	1,208	116,211	9.6
Kingston upon Hull (2)	354	37,067	10.5
Leeds	588	61,597	10.5
Leicester	281	31,330	11.1
Liverpool	1,266	114,080	9.0
London, City and County of	3,376	844,207	25.0
London, Greater	8,391	1,526,548	18.2
Manchester	1,241	128,900	10.4
Newcastle-upon-Tyne	520	43,615	8.4
UNITED KINGDOM (continued):			
Nottingham	424	41,600	9.8
Portsmouth	216	15,136	7.0
Sheffield	512	42,900	8.4
Stoke-upon-Trent	278	14,593	5.2
URUGUAY:			
Montevideo	770	61,548	8.0
VENEZUELA:			
Caracas, D. F.	700	42,911	6.1
UNITED STATES:			
Akron, O.	388	136,018	35.1
Alameda, Cal.	(Included in Oakland)		
Albany, N. Y.	176	74,910	42.5
Albuquerque, N. M.	115	32,793	28.5
Alhambra, Cal.	153	45,596	29.8
Allentown, Pa.	124	42,973	34.7
Altoona, Pa.	90	28,692	31.8
Amarillo, Tex.	79	29,500	37.3
Anderson, Ind.	69	22,098	32.1
Asheville, N. C.	79	23,860	30.1
Atlanta, Ga.	565	193,248	34.2
Atlantic City, N. J.	75	40,094	53.4
Augusta, Ga.	133	29,345	22.1
Aurora, Ill.	63	23,509	37.3
Austin, Tex.	152	48,834	32.2
Baltimore, Md.	950	295,074	31.1
Baton Rouge, La.	162	43,329	26.7
Bay City, Mich.	73	22,890	31.4
Bayonne, N. J.	77	19,952	26.0
Beaumont, Tex.	108	32,732	30.4
Berkeley, Cal.	(Included in Oakland)		
Berwyn, Ill.	54	16,263	30.0
Bethlehem, Pa.	80	26,920	33.8
Binghamton, N. Y.	105	34,631	33.0
Birmingham, Ala.	443	121,493	27.4
Boston, Mass.	732	293,201	40.1
Bridgeport, Conn.	213	75,645	35.6
Brockton, Mass.	71	23,337	32.9
Brookline, Mass.	84	35,783	42.7
Buffalo, N. Y.	732	244,304	33.4
Burbank, Cal.	96	35,998	37.5
Cambridge, Mass.	124	45,606	36.7
Camden, N. J.	127	37,358	29.4
Canton, O.	150	52,046	34.6
Cedar Rapids, Ia.	77	30,101	39.3
Charleston, S. C.	124	28,193	22.7
Charleston, W. Va.	129	40,956	31.9
Charlotte, N. C.	173	53,841	31.1
Chattanooga, Tenn.	196	65,320	33.3
Chester, Pa.	103	30,155	29.4
Chicago, Ill.	3,630	1,495,900	41.2
Cicero, Ill.	67	23,614	35.1
Cincinnati, O.	685	233,817	34.1
Cleveland, O.	1,267	517,618	40.9
Cleveland, Heights, O.	(Included in Cleveland)		

Country and City (or Exchange Area)	Estimated Population (In Thousands)	Number of Telephones	Telephones per 100 Population
United States (continued):			
Clifton, N. J.	(Included in Passaic)		
Columbia, S. C.	156	35,176	22.5
Columbus, Ga.	146	29,916	20.5
Columbus, O.	453	173,354	38.3
Corpus Christi, Tex.	134	36,981	27.6
Covington, Ky.	160	43,116	26.9
Cranston, R. I.	(Included in Providence)		
Dallas, Tex.	525	214,756	40.9
Davenport, Ia.	87	32,344	37.2
Dayton, O.	344	125,725	36.5
Dearborn, Mich.	(Included in Detroit)		
Decatur, Ill.	87	28,519	32.9
Denver, Colo.	420	185,311	44.1
Des Moines, Ia.	210	82,719	39.4
Detroit, Mich.	2,230	828,795	37.2
Dubuque, Ia.	53	18,383	34.7
Duluth, Minn.	115	41,485	36.1
Durham, N. C.	92	22,430	24.3
East Chicago, Ind.	54	13,757	25.4
East Orange, N. J.	145	52,354	36.2
East St. Louis, Ill.	106	24,959	23.6
Elizabeth, N. J.	121	39,799	32.8
El Paso, Tex.	150	37,544	25.0
Erie, Pa.	153	45,804	29.9
Evanston, Ill.	72	34,482	47.8
Evansville, Ind.	155	49,932	32.2
Fall River, Mass.	131	34,062	26.0
Flint, Mich.	207	70,748	34.2
Fort Smith, Ark.	64	18,758	29.5
Fort Wayne, Ind.	140	59,135	42.2
Fort Worth, Tex.	348	115,220	33.1
Fresno, Cal.	145	52,516	36.2
Gadsden, Ala.	71	14,321	20.1
Galveston, Tex.	72	28,164	39.3
Gary, Ind.	140	38,826	27.8
Glendale, Cal.	92	37,876	41.2
Grand Rapids, Mich.	249	95,049	38.2
Green Bay, Wis.	70	21,947	31.4
Greensboro, N. C.	109	31,874	29.3
Greenville, S. C.	98	27,357	28.1
Hamilton, O.	75	22,143	29.6
Hammond, Ind.	81	22,388	27.5
Hamtramck, Mich.	(Included in Detroit)		
Harrisburg, Pa.	145	63,334	43.7
Hartford, Conn.	284	123,684	43.5
Highland Park, Mich.	(Included in Detroit)		
Hoboken, N. J.	(Included in Jersey City)		
Holyoke, Mass.	79	24,198	30.6
Houston, Tex.	688	255,066	37.1
Huntington, W. Va.	94	32,045	34.2
Indianapolis, Ind.	549	203,598	37.1
Irvington, N. J.	(Included in Newark)		
Jackson, Mich.	86	31,799	37.2
Jackson, Miss.	115	35,395	30.7
Jacksonville, Fla.	281	69,965	24.9
United States (continued):			
Jersey City, N. J.	351	96,648	27.5
Johnstown, Pa.	109	24,867	22.8
Joliet, Ill.	96	26,183	27.4
Kalamazoo, Mich.	106	39,599	37.4
Kansas City, Kans.	(Included in Kansas City, Mo.)		
Kansas City, Mo.	639	263,489	41.2
Kenosha, Wis.	64	19,832	31.2
Knoxville, Tenn.	200	56,798	28.3
Lakewood, O.	(Included in Cleveland)		
Lancaster, Pa.	86	34,802	40.4
Lansing, Mich.	145	55,938	38.6
Laredo, Tex.	53	7,669	14.5
Lawrence, Mass.	114	30,124	26.4
Lexington, Ky.	94	24,092	25.5
Lima, O.	57	22,624	39.8
Lincoln, Neb.	104	40,997	39.6
Little Rock, Ark.	177	55,394	31.4
Long Beach, Cal.	269	108,207	40.2
Lorain, O.	57	16,350	28.7
Los Angeles, Cal.	1,900	827,582	43.6
Louisville, Ky.	438	146,242	33.4
Lowell, Mass.	122	30,755	25.2
Lubbock, Tex.	82	22,147	27.2
Lynn, Mass.	117	45,339	38.8
Macon, Ga.	114	28,643	25.1
Madison, Wis.	114	46,516	40.7
Malden, Mass.	61	18,162	29.9
Manchester, N. H.	88	24,922	28.4
McKeesport, Pa.	121	32,547	26.8
Medford, Mass.	61	16,695	27.3
Memphis, Tenn.	463	140,915	30.4
Miami, Fla.	473	175,370	37.1
Miami Beach, Fla	(Included in Miami)		
Milwaukee, Wis.	839	293,320	35.0
Minneapolis, Minn.	648	267,221	41.2
Mobile, Ala.	197	45,977	23.4
Montgomery, Ala.	146	29,901	20.5
Mt Vernon, N. Y.	79	27,289	34.8
Muncie, Ind.	71	23,944	33.8
Nashville, Tenn.	267	94,801	35.5
Newark, N. J.	522	188,286	36.1
New Bedford, Mass.	136	40,008	29.4
New Britain, Conn.	83	26,528	31.8
New Castle, Pa.	71	21,695	30.7
New Haven, Conn.	252	100,860	40.0
New Orleans, La.	641	202,306	31.5
New Rochelle, N. Y.	65	23,973	36.8
Newton, Mass.	81	31,809	39.4
New York, N. Y.	8,000	2,956,832	37.0
Niagara Falls, N. Y.	93	31,379	33.6
Norfolk, Va.	245	72,104	29.4
Oakland, Cal.	643	275,524	42.8
Oak Park, Ill.	63	27,385	43.3
Ogden, Utah	88	25,768	29.4
Oklahoma City, Okla.	259	110,873	42.7
Omaha, Neb.	283	109,699	38.8

TELEPHONE DEVELOPMENT OF LARGE CITIES—Continued

Country and City (or Exchange Area)	Estimated Population (In Thousands)	Number of Telephones	Telephones per 100 Population	Country and City (or Exchange Area)	Estimated Population (In Thousands)	Number of Telephones	Telephones per 100 Population
UNITED STATES (continued):				UNITED STATES (continued):			
Orlando, Fla.	71	22,306	31.4	Seattle, Wash.	572	258,545	45.2
Pasadena, Cal.	170	77,700	45.7	Shreveport, La.	181	53,545	29.7
Passaic, N. J.	160	45,703	28.5	Sioux City, Ia.	86	31,888	37.1
Paterson, N. J.	175	54,506	31.1	Sioux Falls, S. D.	56	20,555	36.4
Pawtucket, R. I.	132	34,174	25.9	Somerville, Mass.	99	24,654	24.9
Peoria, Ill.	174	59,050	33.9	South Bend, Ind.	193	60,693	31.5
Philadelphia, Pa.	2,063	740,183	35.9	South Gate, Cal.	(Included in Los Angeles)		
Phoenix, Ariz.	225	62,662	27.8				
Pittsburgh, Pa.	1,036	388,060	37.5	Spokane, Wash.	195	73,334	37.6
Pittsfield, Mass.	55	21,400	38.9	Springfield, Ill.	100	39,500	39.7
Pontiac, Mich.	121	40,869	33.8	Springfield, Mass.	202	76,752	38.0
Port Arthur, Tex.	73	22,409	30.9	Springfield, Mo.	91	30,026	33.0
Portland, Me.	108	38,853	35.9	Springfield, O.	92	32,625	35.5
Portland, Ore.	475	191,880	40.4	Stamford, Conn.	76	31,051	40.9
Portsmouth, Va.	112	21,435	19.1	Stockton, Cal.	119	37,532	31.5
Providence, R. I.	367	121,655	33.1	Syracuse, N. Y.	259	99,476	38.4
Pueblo, Colo.	87	24,863	28.6	Tacoma, Wash.	189	66,341	35.1
Quincy, Mass.	84	27,720	33.1	Tampa, Fla.	186	52,908	28.5
Racine, Wis.	86	28,922	33.8	Terre Haute, Ind.	100	25,820	25.9
Raleigh, N. C.	96	27,916	29.2	Toledo, O.	355	134,601	37.9
Reading, Pa.	147	52,783	36.0	Topeka, Kans.	103	37,017	36.1
Richmond, Cal.	128	23,424	18.3	Trenton, N. J.	195	57,909	29.7
Richmond, Va.	269	102,803	38.2	Troy, N. Y.	85	24,894	29.4
Roanoke, Va.	114	36,163	31.7	Tucson, Ariz.	107	35,967	33.6
Rochester, N. Y.	419	138,959	33.2	Tulsa, Okla.	203	92,481	45.6
Rockford, Ill.	137	46,975	34.3	Union City, N. J.	163	45,164	27.7
Sacramento, Cal.	225	82,735	36.8	Utica, N. Y.	135	41,325	30.7
Saginaw, Mich.	123	39,398	32.2	Waco, Tex.	95	27,797	29.2
St. Joseph, Mo.	86	30,135	35.0	Washington, D. C.	791	465,148	58.8
St. Louis, Mo.	984	375,874	38.2	Waterbury, Conn.	113	40,896	36.2
St. Paul, Minn.	374	144,221	38.6	Waterloo, Ia.	70	23,887	34.1
St. Petersburg, Fla.	124	34,439	27.9	Wheeling, W. Va.	72	25,292	35.1
Salt Lake City, Utah	217	84,012	38.7	Wichita, Kans.	194	75,680	39.0
San Angelo, Tex.	56	12,393	22.2	Wichita Falls, Tex.	74	24,321	32.9
San Antonio, Tex.	458	119,790	26.2	Wilkes-Barre, Pa.	118	32,975	27.9
San Bernardino, Cal.	70	25,234	36.0	Wilmington, Del.	160	66,434	41.5
San Diego, Cal.	300	107,229	35.7	Winston-Salem, N. C.	119	32,839	27.5
San Francisco, Cal.	788	429,678	54.5	Woonsocket, R. I.	71	19,206	27.2
San Jose, Cal.	160	52,395	32.7	Worcester, Mass.	212	73,019	34.4
Santa Monica, Cal.	148	54,466	36.8	Yonkers, N. Y.	151	44,653	29.6
Savannah, Ga.	151	36,516	24.2	York, Pa.	97	21,776	22.5
Schenectady, N. Y.	145	57,587	39.8	Youngstown, O.	225	71,973	31.9
Scranton, Pa.	146	44,458	30.4				

Twenty-five Years Ago in the

Bell Telephone Quarterly

Items from Volume V, Number 1, January 1926

The Semi-Centennial of the Telephone

Of all the agencies employed in the communications of the world, the telephone is the most wonderful. More than any other, the telephone art is a product of American institutions and reflects the genius of our people. The story of its development is a story of our own country, of American enterprise and American progress. With very few exceptions, the best that is used in telephony everywhere in the world to-day has been contributed by America.

During the year 1926 will be observed with appropriate ceremonies the semi-centennial of the invention of the telephone. Much will be said and written concerning the marvels which have been achieved during the past fifty years, in extending its use among all the people of our nation by means of a continental system of wires and by the most recent marvel of the radio. These things are largely dependent upon the fundamental discovery which was made by Alexander Graham Bell and upon the unremitting labors of the scientific men in those laboratories founded by him fifty years ago and which bear his name.

So much has been achieved during the last half century in the scientific and business development of the telephone in America, that we can look forward with a confidence born of experience to the astonishing things that will have been accomplished by the successors of Bell at the end of the next fifty years, when our country celebrates the second hundred years of its existence as a nation.

While it is impossible to predict in detail what will be the nature of these great new developments, we can be sure that the problems which we can now see ahead of us contain the promise of marvels greater than anything which we can now imagine.

As recently stated by Mr. W. S. Gifford, President of the American Telephone and Telegraph Company, "The advances which have been made during the first fifty years of the work of the Bell System are unparalleled in the history of communications. They are contributions which will make forever memorable this great epoch in our progress. We are now at the beginning of a new era filled with boundless opportunities for advancement in the business and science of telephony. Upon the foundations which have been so securely laid, we can look forward to the telephone system of the future which, in effectiveness and useful service, will surpass all that has gone before."

From an article by the late John J. Carty, then chief engineer of the A. T. & T. Co.

A New Record in Military Communications

An experiment in the transmission of photographs over telephone lines, carried out on October 2, 1925, through the co-operation of the United States War Department and the American Telephone and Telegraph Company, set a new record for the rapid communication of military intelligence.

A photograph of the barracks at Fort Leavenworth, Kan. (theoretically occupied by enemy troops), which had been taken from a military observing plane at 10.57 A.M., was placed in the hands of army officers in New York at 11.17½ A.M.—twenty-nine and a half minutes from the snapping of the shutter to the delivery of the finished picture at a point 1,100 miles away. Simultaneously pictures were flashed by the Bell System telephotographic process to the commanders of Army Corps areas in Chicago and San Francisco, the finished print being delivered at the latter point thirty-seven minutes after the photograph was taken.

The success of the experiment was due to a combination of the system of sending pictures by wire with a new process of developing photographs in an airplane, perfected by army photographers. After making the exposure, the military photographer immediately began developing the film and when, nine minutes later, the plane flew over the nearest telephone office, the negative, attached to a small parachute, was dropped overboard.

At 11.05½ the photograph was put on the wire. Twelve minutes later the completed picture was received in New York and at 11.22 A.M. officials at Fort Leavenworth had received a telegram from their associates in New York, reporting the satisfactory reception of the print and declaring the skill of the Air Service and of the American Telephone and Telegraph Company to be "worthy of the highest praise."

From "Notes on Recent Occurrences"

Sound Your "Ah"

The St. Louis *Star-Times* reports an incident which transpired recently in McAllen, Texas. As the newspaper tells it, "A woman got on the wahr and tried to telephone the nearby town of Pharr. The hahred hand on the switchboard thought she was reporting a fahr. So, without stopping to inquahr, she sounded the fahr alarm and aroused the entahr community. Most of the volunteer fahr fighters had already retahred. They began to perspahr and struggle into their fahrfighting attahr. It was the nicest little mixup you could desahr." Inspahred by the entahr affair, the *Star-Times* warns its readers that, "Some people are used to damyankee accents," and suggests that they acquahr the habit of speaking plainly on the telephone. "When you mean Pharr, say Pharr," it advises, "and when you mean fahr, say fahr."

Who's Who & What's What

(*Continued from page* [illegible])

1928, after several years of editorial and publishing experience, he transferred five years later to the corresponding department of the A. T. & T. Company, where he has been for the past eight years editor of this MAGAZINE. (Both pictures on p. 241 from International News Photos.)

MUCH of the information—annual reports, correspondence, publications, and the like—received from foreign telephone administrations in connection with the A. T. & T. Company's bulletin "Telephone Statistics of the World" is written in languages other than English, and ELIZABETH WRENSHALL finds her extensive travels and her two year teaching experience in Rome have given her a facility in languages which is useful in gathering and compiling the data which she uses in her daily work. After making translations for the censorship authorities during World War II, Miss Wrenshall joined the A. T. & T. Company six years ago, and has been with the foreign statistics group in the Chief Statistician's Division of the Comptroller's Department for the past five years. To this MAGAZINE for Winter 1949-50 she contributed "This Country Leads the World in Telephones."

"Fifty Years With A. T. & T."

A FINANCIAL WRITER for the Wall Street Journal who has covered the American Telephone and Telegraph Company for 50 years recently devoted his column "Abreast of the Market" for November 8, 1950, to the growth of that company's financial structure and plant investment in the first half of the 20th century. Here's what he had to say:

"On November 8, 1900, fifty years ago, the editor of this column arrived in New York City and shortly thereafter went to work for Dow Jones. On November 8, 1900, the stock of American Telephone and Telegraph was selling on the Boston Stock Exchange at about the same price the stock is now selling on various exchanges throughout the country: $150 per share. Since that time, the authorized capital stock of A. T. & T. has increased from a million shares to 35 million through sales of additional shares of stock. Beginning in July, 1900, the annual dividend rate on this stock was set at $7.50 a share, and since 1922 the rate has been maintained at $9 a share. In 1900 the company was barely beginning its long program of public financing with an exchange of stock with the original American Bell Telephone Company. At that time the company had slightly less than a million instruments in use. Today the total is in excess of 34,320,000. A closer parallel between industrial expansion, taking the number of instruments in use, and the price of the capital stock would be difficult to find. Both are about 35 to one.

"While the editor of this column was covering A. T. & T. for The Wall Street Journal during the 1920s and the great depression of the 'thirties, he kept on hand for future use a form statement of the company's coming dividend declarations. They never varied, a fact which has made the stock of A. T. & T. perhaps the prime investment in the nation today. Fifty years ago there were 7,536 stockholders. Today A. T. & T. has 971,000, including 40,100 trusts, corporations, charitable institutions, etc., with an average holding of 28.5 shares. The largest single corporation in the world—with plant and equipment worth nearly $10 billion and annual operating revenues of about $3 billion today serve a nation of more than 150 million persons. And these people—through A. T. & T.'s system—now carry on an average of 142 million telephone conversations per day."

"A Basic Policy for a Basic Service"

NEXT TIME you walk down Main Street in your home town, take a good look at the signs in front of the stores. . . . "Founded 1900" . . . "Established in 1880" . . . "Serving since 1922."

Yes, a business takes pride in the long years it has served the community. So do its employes, and the community, too. Actually, every year a firm remains in business is a vote of confidence by the public it serves: confidence in that firm's sound business management, confidence in its desire to give good merchandise or service at a fair price.

It is that way with the Bell System, too, which next March celebrates the 75th Anniversary of the invention of the telephone. Over the years the Bell System, like any other business, has been faced with grave problems, sometimes involving service, sometimes the welfare of our employes, sometimes safeguarding the stockholders.

Consistently, we have measured every problem against the basic policy of the Bell System, first publicly expressed many years ago. That policy, in brief, is "to provide the most telephone service and the best at the lowest cost consistent with financial safety and fair treatment for the employes."

Guided by that policy, the Bell System has always reached solutions that in the long run have made it a good place to work for the employe, a good investment for the stockholder, and its service the best in the world.

Thus, we can best maintain the confidence of the public, of our employes, and the hundreds of thousands of people who have invested part of their savings in the Bell System.

Telephone Story on the "Telephone Hour" radio program

"Three Ships"

A STORY IS TOLD of the student whose examination paper showed notable conciseness in explaining the outcome of a naval battle. The loser, he wrote, "lacked three ships:—seamanship, marksmanship, leadership."

He could have listed the same three "ships" had the question concerned the factors that go to make a successful business enterprise.

Seamanship: The ability to weather rough seas that are bound to trouble any enterprise from time to time. This means a soundly financed, sturdily built organization which combines human and physical resources in such a way as to insure steadiness in any kind of going.

Marksmanship: The ability to hit objectives—not only those close at hand for today or tomorrow but those at a distance which require complex planning for the future.

Leadership: The direction of human activities with skill, with wisdom, and—above all—with the fairness and thoughtfulness that build all hands into a good-spirited crew.

Seamanship, marksmanship, leadership. These characteristics, with all that they imply, are the vital responsibilities of management.

They represent qualities that no business can do without. This is especially true in an enterprise such as ours. To manage the human activities and the equipment behind Bell System communications is to manage the most complex system of service the world has ever seen.

Times have changed since the old days when a man who owned a business always managed it too. The mill, the factory, the shop, the store were run by the men who put up the money. Thousands of businesses are still operated that way. But in the large businesses like ours a large group of people, usually starting at the bottom of the ladder and working up, now run the business for the owners, employees, and public.

These people are management. And management is a profession. It takes training, initiative, and far-sightedness—or the three ships mentioned earlier.

Management people at all levels must make decisions. When added up, these decisions can affect, for good or bad, the future of the business, the security of employees, and the savings of investors.

All this is a large order. Success is determined by how well the "captains" know the seas.

From the "Items for Management" bulletin of the Long Lines Department of A. T. & T.

ıe XXX ~ Number One *Spring 1951*

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MAGAZINE

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Bell Telephone Magazine

Spring 1951

A Medium of Suggestion & a Record of Progress

Published for the supervisory forces of the Bell System by the Information Department of
AMERICAN TELEPHONE AND TELEGRAPH CO., *195 Broadway, New York 7, N. Y.*
LEROY A WILSON, *President;* CARROLL O. BICKELHAUPT, *Sec.;* DONALD R. BELCHER, *Treas.*

Who's Who & What's What *in This Issue*

The unique photographs of Alexander Graham Bell shown on pages 208–211 of the article "The Telephone's Inventor Elected to Hall of Fame" in this Magazine for Winter, 1950–51, were taken by Dr. Gilbert Grosvenor and are copyrighted by him. They were made available for publication here through the kindness of Mr. Melville Bell Grosvenor.

By both position and experience, Ralph E. Mooney is ably qualified to tell us about the telephone's first seventy-five years. Historical Librarian of the A. T. & T. Company's Historical Library since 1945, he had been before that Editor of the *Southwestern Telephone News* of the Southwestern Bell Telephone Company, and he had had some years of newspaper and trade journal work before joining that company in 1924. He came to the Information Department of A. T. & T. in 1944 from St. Louis. "Robert Devonshire's Letterbook," published in this Magazine in the issue for Summer, 1949, is his most recent contribution to these pages.

The five years before Myrtus A. Davis began his Bell System career included experience with three engineering firms, a year as a teacher of engineering, and service in World War I. In 1920 he joined the engineering division of the Department of Operation and Engineering of the A. T. & T. Company in New York. His observations on the importance of little things in the telephone industry reflect his three decades and more of interest in problems relating to the design, installation, and upkeep of central office and station equipment.

The first description of the Bell System's opinion surveys—the methods and findings—was published in this Magazine five years ago, in the issue for Spring, 1946. C. Theodore Smith was a co-author with Arthur H. Richardson, now retired, of

Ralph E. Mooney

Myrtus A. Davis

C. Theodore Smith

Peter A. Dolan, Jr.

John K. Torbert

"Finding Out What People Think of Us." Mr. Smith joined the Statistical Division of the Comptroller's Department of A. T. & T. in 1929 and his present title is "Statistician—General Research."

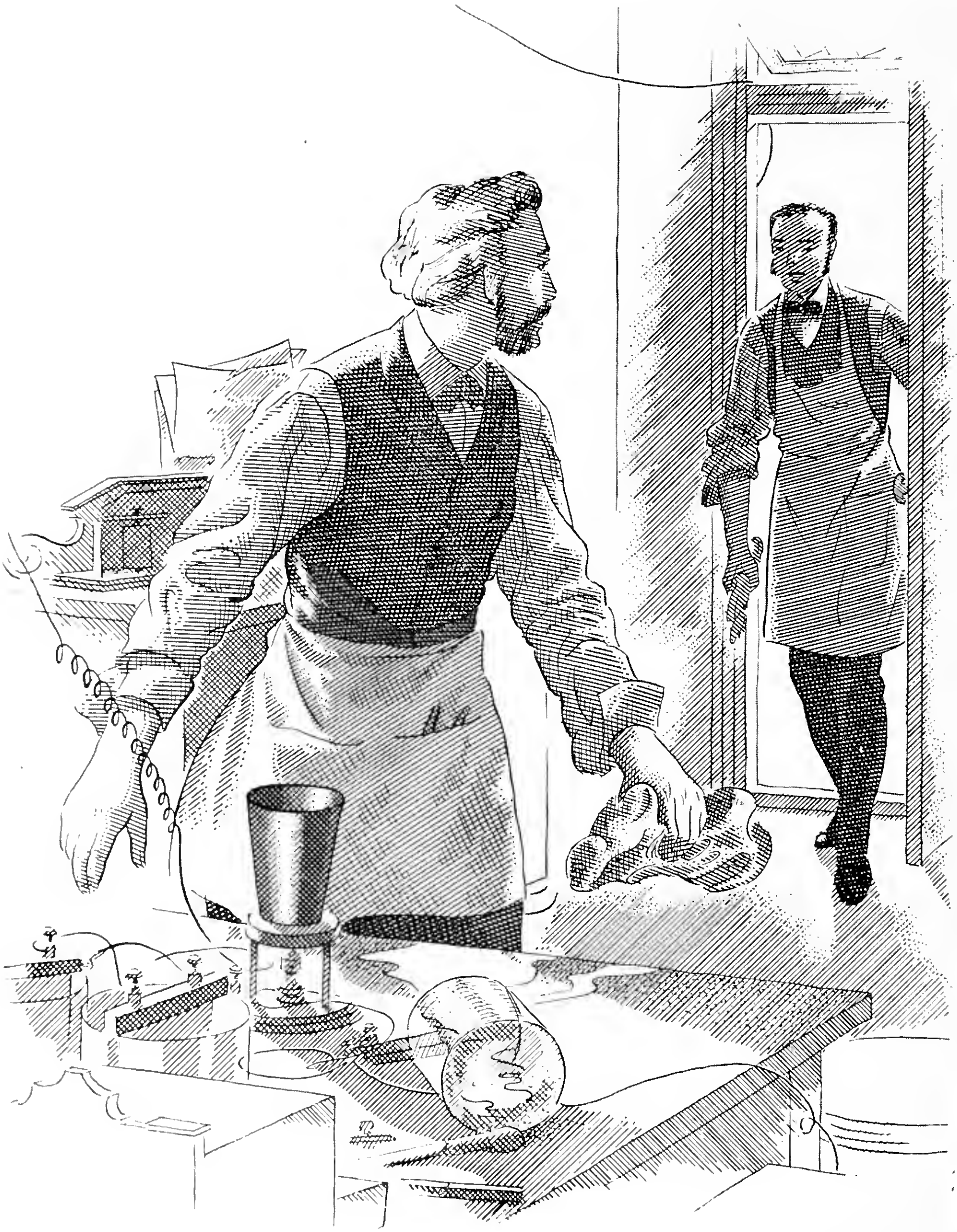
AFTER FOUR YEARS in the Army Signal Corps during World War II, PETER A. DOLAN, JR., spent five and a half years in metropolitan newspaper work in New York City—including police, sports, and financial reporting—before joining the Public Relations Department of the New York Telephone Company as a staff writer in January of 1950.

(The aerial view of New York City used with Mr. Dolan's article was obtained from Fairchild Aerial Surveys, Inc.)

EXPERIENCE in a bank, as a teacher of English, and in two well known publishing houses preceded JOHN K. TORBERT'S entrance in 1921 into the Treasury Department of the A. T. & T. Company, where he is now supervisor of the Communications Bureau. His "Answering Stockholders' Letters by Telephone" was published in the *Bell Telephone Quarterly* in October, 1935.

Index Now Available

AN INDEX to Volume XXIX (1950) of the BELL TELEPHONE MAGAZINE may be obtained without charge upon request to the Information Department, American Telephone and Telegraph Company, 195 Broadway, New York 7, N. Y.



"Mr. Bell, I heard every word you said—distinctly!" exclaims Thomas Watson as he hurries through the door in response to Alexander Graham Bell's urgent summons: "Mr. Watson, come here! I want you!" That first sentence ever to be transmitted by telephone was spoken seventy-five years ago last March 10. *See the article beginning on the opposite page.*

In the Three-Fourths of a Century Since Bell's Invention Carried Its First Message, the Telephone Has Achieved a Position of Vast Importance to Our Way of Life

The First 75 Years

Ralph E. Mooney

Author's Note: Any review of historical affairs must include some interpretation of trends and events. Where this occurs in the present material, it is perhaps needless to remark that the opinions and deductions of this writer are not necessarily those of the management of American Telephone and Telegraph Co.

BELL'S TELEPHONE transmitted its first complete sentence on March 10, 1876, between two rooms on the top floor of the boarding house at 5 Exeter Place, Boston, where Bell had been experimenting with it. After demonstrations and tests during the rest of that year, it passed quickly into public service. By May of 1877, fourteen months after the first sentence was transmitted and only eleven months after the notable public demonstration at the Philadelphia Centennial Exposition, telephones were being rented to the first Bell customers. They were rented in pairs, to be used on private lines, and by October 1877, about two thousand were in service.

Viewed in perspective, the story of American telephone service from then on is amazing.

We in the business can say this in all modesty, for we are not taking credit for the amazing factor in that story—the public attitude which changed so swiftly from amused indulgence of a novel gadget to steadily increasing demand for service.

The telephone is a means of communication. Other means may be used for the same purpose. How is it that America made such wide use of this means while the rest of the world did not?

Our statisticians recently calculated that if telephones in the United States bore the same relation to population as in the eight foreign nations with greatest telephone development, we should now have less than ten million telephones in this country. Instead of which, we have more than 35,000,000 Bell and eight million In-



Operators Then and Now:—The cumbersome headset at the right was used for a short while in 1878. The operator at the left was photographed about 1900. Today's operator, center, wears the Bell Laboratories' latest development in headsets

dependent telephones in the United States—43,000,000 altogether—and this, after starting from a figurative "one" in 1876, with less than a year's headstart over these other nations. Why the disparity?

National Temper and Income

"DEMOCRACY" is one explanation: our telephone service is a result of free enterprise in a free land. Such a service could only have grown where freedom encouraged such a man as Bell to indulge his vision of some day "talking by telegraph," and where other men of vision and science, year after year, were encouraged to contribute the inventions and improvements that added to the reach of the human voice until it became possible to carry on a conversation across the continent or even around the world as easily as across the street. These considerations indicate something more, however. First of all, America's real wages or purchasing power, increasing decade by decade, combined with the telephone industry's accomplishment in reducing telephone rates from time to time or preventing rates from rising as high as the general price level during inflationary periods, made it possible for a constantly greater number of people to make use of telephone service. Also, there is undoubtedly, in the American democracy, a national temper or mental attitude that does not hesitate to go after what it wants, and that feels free to do so at any time.

This national temper was, and is, an amazing factor in the growth of our telephone service. Enterprise played its part capably in demonstrating what the telephone could do, and in educating people to use it. And, since management was left free to do this, our form of government accounts to a large extent for the growth, in a little more than three score years and ten, of national facilities that carry an estimated 170,000,000 conversations a day.

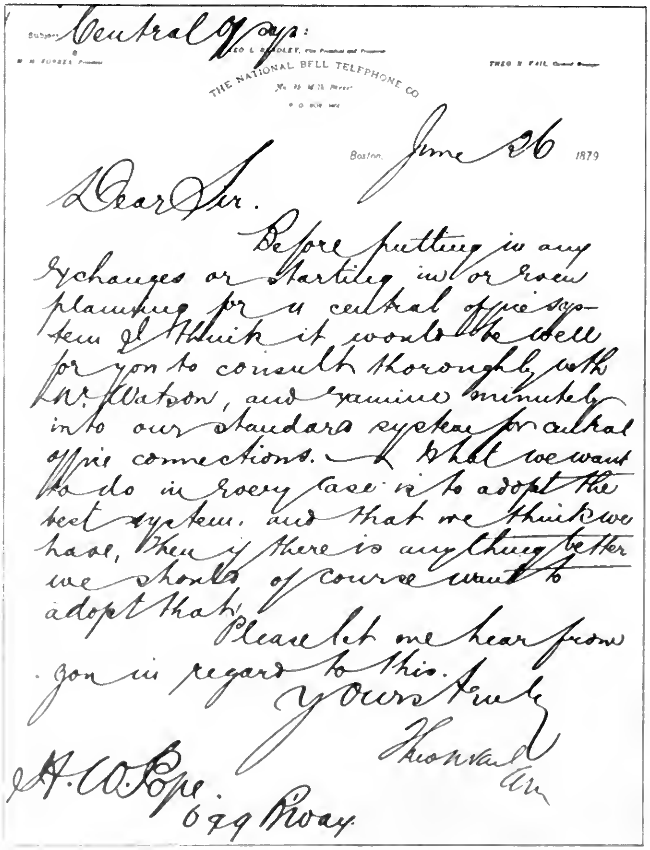
But ever and always it was the American people who adopted telephone service as soon as they had been convinced of its value, and who became the customers that kept management hard-pressed to provide a service to meet their needs.

The Growth of Cities

THE TELEPHONE came on the scene during a great population shift from farm to city. This had been under way in America for several generations, caused partly by dislike of isolation and envy of the city dweller's lot, but chiefly by the growth of the factory. As manufacturing increased, cities had become labor markets, and cash income was the main incentive that held people in town and drew others from rural districts.

Arthur Schlesinger notes in *Growth of the American People* that, in 1830, one out of every fifteen persons in the United States dwelt in places of 8,000 or more population. By 1860, it was one out of six; and by 1890, three out of ten—very nearly one out of three. Schlesinger also calls attention to the fact that during the century from 1790 to 1890, the urban population in the United States grew 139-fold while the total population increased but 16-fold—"this despite the titanic energies that had gone into subduing the wilderness."

So the telephone was in no way a cause of big city growth. But coming when it did, it had considerable influence on the form of American cities. Steam and electric street transportation dates from about the time



Subject: Central Offs:

THE NATIONAL BELL TELEPHONE CO.

Boston, June 26 1879

Dear Sir.

Before putting in any Exchanges or starting in or even planning for a central office system I think it would be well for you to consult thoroughly with Mr. Watson, and examine minutely into our standard system for central office connections. What we want to do in every case is to adopt the best system, and that we think we have. Then if there is anything better we should of course want to adopt that.

Please let me hear from you in regard to this.

Yours truly

Theo N Vail
Gen Man

A. W. Pope.
699 Bway.

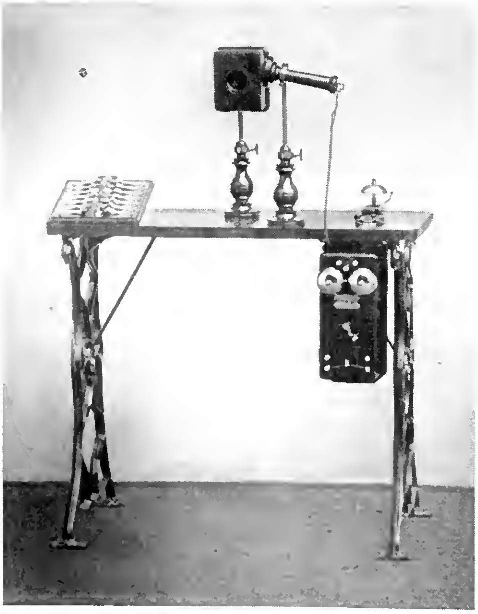
As early as 1879, Theodore N. Vail, then general manager of the National Bell Telephone Company and later head of the entire Bell System, established the standard of telephone operation when he wrote a prospective exchange founder that "What we want to do in every case is to adopt the best system, and that we think we have. Then if there is anything better we should of course want to adopt that."

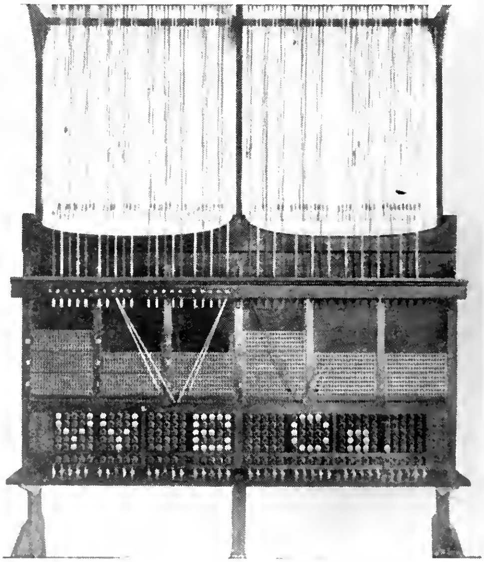
of the telephone itself. Steam and hydraulic elevators had been in use since the 'Fifties, but the first electric elevator was to go into service in 1889. The telephone combined with the street railways and elevators to lift city buildings to skyscraper heights.

During the last three decades, however, the trend has been the other way—from the cities toward the country. Highway and rail transportation, pavements, and street and snow-cleaning equipment have made possible much wider dispersion of business and residence areas, and suburban populations have been growing at a rate from two to three times faster than city populations. Therefore, the telephone is today a main reliance of those who plan to live in the suburbs or to set up industrial plants in rural surroundings.

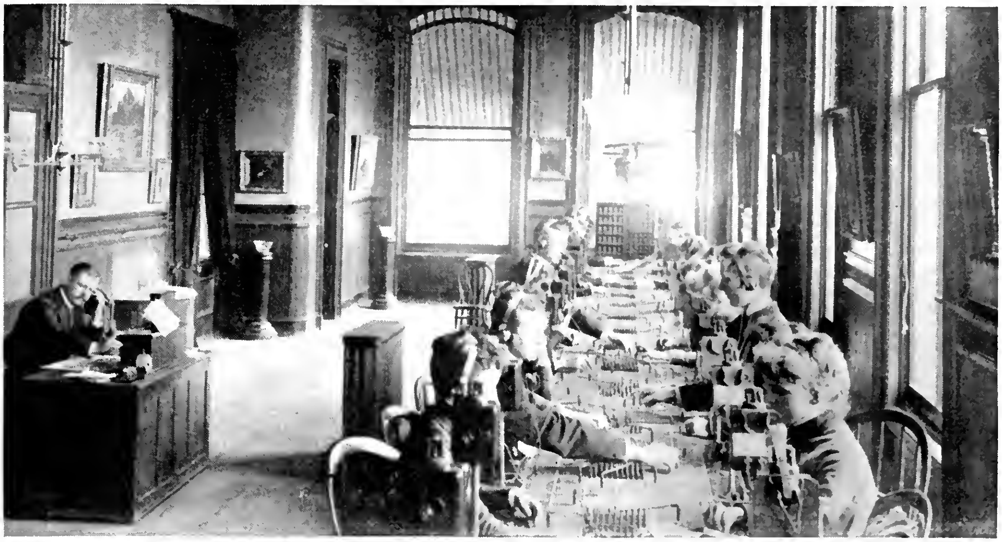
Pattern for Growth

A COMBINATION of circumstances caused the burden of starting the telephone business—and the Bell System—to fall on four men: Gardiner Greene Hubbard and Thomas Sanders, who had financed Bell's experiments; Thomas A. Watson, who had been his laboratory assistant; and Charles Williams, Jr., who manufactured the first telephones in his electrical shop at 109 Court Street, Boston, and who incidentally furnished





Switchboards for interconnecting subscribers' telephones were a major concern of early telephone men. The 1879 model at the left was the operator's position in a system which also required the services of a switchman at the frame where the lines terminated. He had to tell her when there was a call to answer and she had to tell him which lines to connect. The model at the right, manufactured by the Western Electric Company—note the initials spelled out by the "drops"—for use in Detroit in the mid-'Eighties, represents a transition toward the normal manual switchboard, although the plugs are drawn down from above to establish connections



This Law switchboard served at St. Louis through the 'Eighties. Girl operators had not yet entirely ousted boys from the operating room, and the male chief operator and manager was an important part of the picture

the first Bell Telephone Company with office space there.*

These four set the pattern for Bell System growth. They were responsible, first of all, for the policy of renting telephones instead of selling them outright to let the buyer make what use he might of them. This made the "telephone company," and its licensed representatives, responsible not only for telephones but for the service they gave; obviously, the most far-sighted and proper policy that could have been adopted. It has contributed vastly to the present eminence of American telephone service. Had the counterproposal—to sell outright—prevailed, the incentive to steadily improving service would have fallen to other and, quite possibly, less interested hands. Certainly, development would have been hindered by diverging interests and confused standards.

What might have been is unimportant, however. These four men did start the Bell Telephone System. Hubbard and Sanders, at the head of the enterprise, gave way in turn to Colonel William H. Forbes, Howard Stockton, John E. Hudson, Frederick P. Fish, Theodore N. Vail, Harry B. Thayer, Walter S. Gifford, and Leroy A. Wilson. Watson, as research head, was succeeded by Thomas D. Lockwood, Ezra T. Gilliland, Hammond V. Hayes, John J. Carty, Frank B. Jewett, and Oliver E. Buckley. As engineer and inventor, Watson's work was taken up by Charles Scribner and Leroy Firman, who improved the early switchboards with nearly incredible speed; John A. Barrett, who was responsible for transposition circuits and cable; Anthony C. White, who developed the forerunner of the present-day transmit-

* See "Robert Devonshire's Letterbook," MAGAZINE, Summer 1949.

ter, and the host of others who attacked and solved specific problems. Charles Williams, when he retired, was among those who were responsible for choosing Western Electric Company, as the best of six manufacturers then in the field, to become the manufacturing and supply organization of the System.

The original Boston headquarters licensed agents to rent telephones to customers in specified areas. After George W. Coy had opened the first commercial exchange at New Haven, on January 28, 1878, new licenses were issued to telephone exchange companies. Headquarters furnished the telephones and gave as much advice and assistance as was possible. Bell System headquarters in general continues these functions today. But since the American Telephone and Telegraph Company, which is now headquarters company of the System, was organized in 1885 to build and operate long distance lines, it continues that function too, through its Long Lines Department.

Litigation and Competition

THIS WAS the framework within which, growing as the nation grew, the Bell Telephone System has come to furnish its present four-fifths share of the country-wide telephone service.

Looking strictly at "now" without reference to "then," it is a temptation to conclude that the building of the Bell System was a task that called only for steady steering along an easy course. But that is far from true. From the moment the telephone had proved its commercial value, it had attracted inventors to seek a way to duplicate it without infringing the basic patents taken out by Bell, one in 1876 and the other in 1877.

Bell's telephone was an amazingly simple device. It seemed that there must be some way to make another that would give the same service without using the methods covered in his patents. In time, it became evident there was no other way, but many an inventor sincerely believed he had found one—until the courts ruled otherwise. A condensed narrative of the litigation to protect the Bell patents from sincere and insincere inventors makes a volume of 795 large pages. The validity of the patents was tested in more than 600 such legal actions, all of which ended in success for the Bell System, only five of them going to the United States Supreme Court. But while the cases were in progress, the fighting was bitter. In fact, a few men made a kind of hit and run, guerilla warfare of it by operating a telephone service until enjoined from so doing, then reopening under another name or in another combination elsewhere.

The Bell companies had very little capital to start with, but throughout most of the years of litigation, they were able to find money for their needs and support for their undertakings with reasonable ease. Nevertheless, their resources throughout that period were relatively small compared to the resources sometimes gathered against them in the courts. For, as telephone service developed and the prize became richer, many able and ingenious adventurers were tempted to muscle in on it—to use modern vernacular. But the Bell companies won through.

When the basic patents expired in 1893 and 1894, the methods and apparatus protected by them went into the public domain. This made it possible for anyone to go into the telephone business without license from the Bell. The companies that undertook to do so came to be called Independents because they did not need this license. Competition between Bell and Independent companies was strenuous for a time, and in some towns and cities two exchanges sought to serve the same public. Many subscribers in such communities felt compelled to use both services, and found this inconvenient as well as expensive. Before long, however, a series of arrangements was worked out whereby duplicating telephone services were consolidated, through retirement of either the Bell or the Independent from a given exchange area, or occasionally by combination of Bell and Independent properties in a new corporation. Moves toward interconnection of Bell and Independent systems for long distance service—that is, moves toward the present nation-wide service—began very early in this century.

Growth Within the License Framework

It appears important to call attention again to the fact that the founders of the System issued licenses to operate Bell telephones under the basic patents, and leased telephone instruments to be used in telephone service. As part payment for the licenses, they often received stock in the local companies. As the original license holders grew in size, it became convenient to combine the managements into larger organizations—until the present System, made up of parent company and 22 wholly or partly-owned regional operating companies, was evolved. This was a joining of smaller Bell units within the original framework of the System.

Most of the subsequent growth of the operating units of the Bell System has been within the framework so established, and has consisted largely of the extension and improvement of facilities to keep pace with the increasing need for service in and between the areas served by the licensee companies.

As has been seen, the problems created by duplicating telephone services within an exchange were solved in some cases by the Bell company purchasing the Independent property,

Adoption of the telephone for fire and police protection was prompt, as illustrated by this woodcut of a street scene in Chicago in the early '80s and in other cases by the Bell company selling to the Independent. But where a duplicating service was purchased, the purchasing company grew in size only by the telephones that were not duplicated, while telephone users gained through having an improved service, and only one telephone bill to pay.

So, although Bell companies have purchased some Independent companies, and some Bell properties have been sold to Independents, the main growth of the Bell System has come through providing service steadily through the years to meet increased demands from constantly growing communities.

The Telephone Art

When Bell had occasion to speak to an audience of electrical engineers in 1916, he said he hesitated to talk of the telephone to men who had gone so far beyond him in the art of making use of the thing he had invented. He found the story as amazing then as we find it today.

By that time, telephone switchboards had developed from crude affairs, which often would not permit more than four simultaneous conversations, to block-long manual boards with lamp signals and divided multiple. Circuits had been improved again and again. The whole art of making lead-sheathed, paper-insulated cables had been developed for so long that most main city lines were underground. The telephone instrument had been the subject of at least five major improvements, and many minor ones.

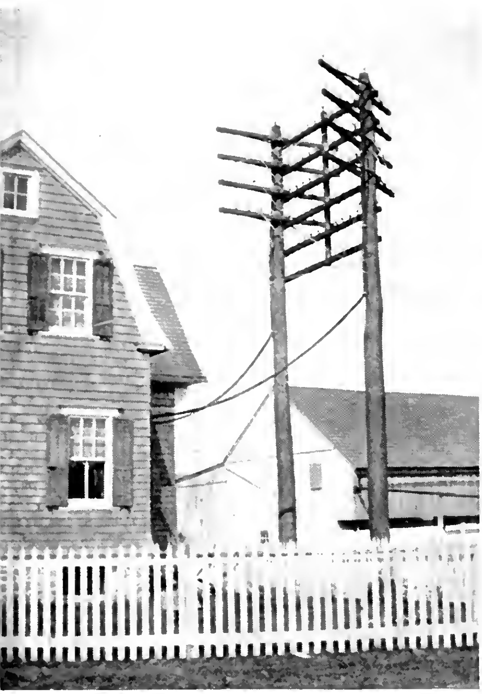
Boy operators had become a legend except in a few small towns, where they still handled the night shift.

And the girls who had replaced the boys had been answering line signals with "Number, please?" since 1895, making it by this year of 1916 one of the most-used word combinations in the English language.

Almon B. Strowger's system for electrical switching of calls, invented in 1889, had had its first installation at La Porte, Indiana, in 1892. By 1916, it had been developed into the step-by-step system and was serving in several large and many small exchanges. The Bell System was soon to make large installations of it, and relatively soon to begin manufacturing it at Western Electric Company under license agreements with the holders of step-by-step patents.

Bell System engineers, who had been giving intense study to dial telephone service since 1905, also had developed a form of switching equipment called panel type. This was especially designed for installation in large multi-office cities, which called for piece-meal change-overs from manual to dial switching. Panel type equipment was ready for service in 1916, but World War I material shortages delayed the first installations until after 1920.

Long distance service, in 1916, reached across the continent, and not far ahead lay the beginnings of trans-oceanic telephone service and ship-shore telephony. Also close at hand was the amazing growth of radio broadcasting from experimental stations (1919) to coast-to-coast networks (1927). Nor must we forget the introduction of carrier telephony (1919), transmission of photographs by wire (1924), and television (1927).

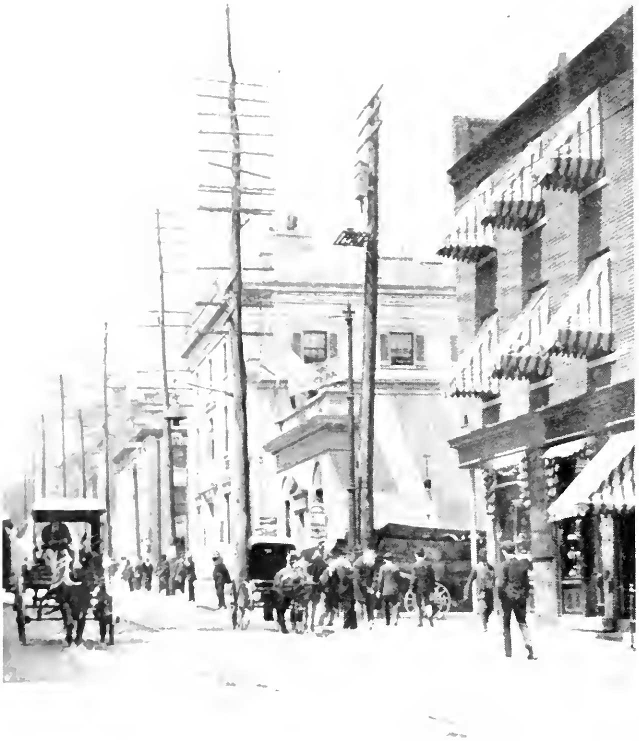


The sturdy "H" fixture was erected to carry lines from three directions into the central office at Temple, Pa., about half a century ago. The terminal pole with the neat "crow's nest," shown at the right, was in service in Tuxedo, Maryland, in 1899

Recent Developments

At a demonstration in 1935, Walter S. Gifford, then President of the American Telephone and Telegraph Co., talked around the world to T. G. Miller, Vice President, in a nearby office at 195 Broadway, New York City. And a year later, 1936, the Bell System made available crossbar switching for dial offices. The first commercial installation of this was cut into service at the Troy Avenue office in Brooklyn, in 1938. In cities with many central offices, crossbar equipment operates more simply than panel or step-by-step, with greater economy of space and less liability to interruption. Since it operates with a minimum of wear on the switching contacts, it permits the use of precious metal contacts, which have superior freedom from noise and other troubles.

Except for the placing of a transcontinental cable line and expansion of service for military needs, construction came to a practical halt as the United States began building defense forces for World War II. But since the war's end, mobile telephone service has extended switched telephone service to automobiles, trucks, taxicabs, ambulances, and trains, and has added many on switch engines, harbor craft, and steam vessels. A coaxial cable network has been placed



A typical scene of half a century ago: the corner of Davis and Lexington Streets in Baltimore, Md., in 1899

in service. Microwave radio relay transmission also has become part of the Long Distance network. Operator toll dialing and automatic message accounting have been developed.

On farms and in rural areas, more than a million and a half telephones, added since the end of World War II, plus installations by Independent companies, continue to assure America of more and better rural telephone service than any other country. Across the land, one out of every two farms has telephone service.

All of these were steps toward a more complete and a better telephone service. Now, in 1951, those who look ahead in the Bell System are working out many more advances, such as equipment by means of which customers can dial calls directly to points all over the country, for one instance, and devices that will automatically answer the telephone and record messages during the absence of the subscriber, for another. Bell Telephone Laboratories also is actively engaged in the development of a number of improvements that will increase the convenience and usefulness of subscribers' station equipment.

The Results

What does all this mean? What effect has seventy-five years of constantly growing and improving telephone service had on our country? What has the steady betterment of equipment done beyond—as the late Clarence Day once said—affording us the opportunity to talk, just talk?

A glance at a modern American community reveals answers to these questions. Community health is protected by public officials and commissions, plus a system of public and private physicians, hospitals and laboratories, linked by telephone lines, capable of quick interconnection and even conference consultation in times of emergency. Police and fire departments are similarly linked, station house to station house, headquarters to city hall, and even car to car, to guard public safety and aid the administration of government.

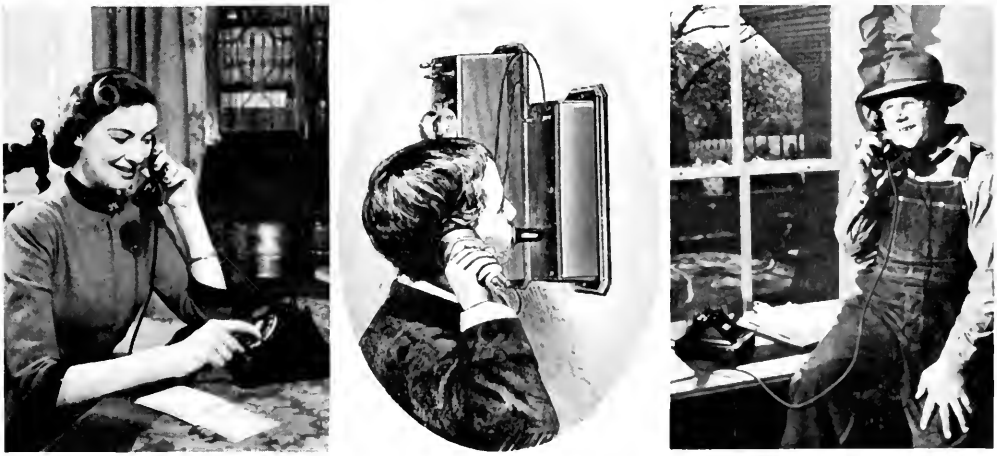
Community livelihood depends largely on telephone transactions. Even retail businesses are carried on nearly as much by telephone as by personal contact. And social life is so bound up with telephone service that it becomes extremely difficult when emergencies such as last November's great storm in the northeastern states cause interruptions that cannot be cleared within a few hours.

Over and beyond these considerations lies that of the peculiar value of the telephone to voluntary civic activities, such as those of the Boy Scouts, the church guilds, and the countless committees and clubs for one purpose and another. For these voluntary activities and self-imposed duties are the very life-blood of democracy. It is through them that its most important work is accomplished, and through them that the public spirit for common endeavor is kept alive.

A WRITER in *Fortune* for February, 1951, puts it this way:

"The truth is that Americans are just about as busy with their non-official, unremunerated, voluntary activities as they are with their official duties; and these unpaid, unofficial, off-duty activities have a deeper and more lasting effect upon American life, and even American policies, than do the official ones. In their official capacities Americans are busy business men, busy lawyers, busy politicians, workers, soldiers, teachers, housewives, etc.; but, when one has described all of that, one has still not touched the unique nerve of American life, which constantly stimulates initiative and at the same time makes these people truly 'self-governed.'

"The tradition is a long one, and was noted by Tocqueville more than a hundred years ago. 'If an American were condemned to confine his ac-



Telephone Users Then and Now: The central drawing, from a very early directory, was accompanied by instructions to place the lips "in the mouthpiece." The modern users demonstrate telephones in service in the city and on the farm.

tivities,' said that sage observer of the U. S., 'he would feel robbed of half his existence.' "

Today, telephone service is a main reliance of the many busy people who engage in the many activities. They are able to notify, consult, and even bring about committee action in a series of calls. And since these social and coöperative activities all aim broadly or narrowly to improve the wellbeing of communities all across the land, the value of dependable telephone service to community and nation can be set high.

The telephone's most important attribute in affairs public and private, local, national, and international, was neatly stated in a recent advertisement: it gets things done quickly.

Plantation Party Line

The following letter was received by the Southern Bell Telephone and Telegraph Company from a new customer on the Last Jump-Off Plantation near Shelby, Miss.:

Thank you for the new telephone line. I'm sure you think we didn't appreciate it, but it is wonderful. The coming of the party line taught me something new to appreciate about the American way of life. For the first few days, the other parties used it continuously, from the smallest to the oldest in the family. They called everybody back and forth and held the baby up to say something. Not knowing the different "rings," I kept answering by mistake for about three days until I learned to distinguish my own ring. Then we realized these people, first generation Americans, had not been accustomed to telephone. Nowhere else are so many enjoying so great a number of benefits as America. We just take our privileges for granted until we see how much it means to those who have never before had such privileges.

Life has settled down now. School has started and the cotton moves to the gin. I can call the schoolhouse or the church or the gas station or the drug store or the hospital, as we did today. Or we can call home or to our friends or on long distance business calls we do each week. That telephone saves a lot of mileage. We sold a tract of timber Saturday by long distance, and arranged to meet Grandma by the same way at Greenwood last week.

As for my new party line neighbors, they're nice too. They take messages if I'm not in (I farm on the turnrow, you know), and tell my friends I'm out so they can call again. Telephones make neighbors out of folks that don't have time to visit.

Goodness, this sounds like a commercial for telephones. Really, it is just intended as gracious thanks for the new line, and appreciation for your part in it.

I simply don't think Last Jump-Off Plantation would be completely mechanized without a good telephone. So thanks to your district manager, and all the nice guys up and down the "lines" who fixed us up with a new party line.

Freedom to Serve in Freedom's Defense

For three quarters of a century the Bell System has rendered service of more and more value to the American people. The telephone began in this country. Here it has been most widely developed and used. Our service has always been the best in the world, and its greatest increase in usefulness has come in the last five years. This is a great asset in helping to defend the freedom of the United States.

Our telephone service is also a product of freedom. In the building of the Bell System, countless discoveries and inventions have had to be achieved by the inquiring spirit of free men. Opportunity has been open to all. Competition has flourished throughout the organization. Worthwhile incentives and reasonable rewards have fostered the will and capacity for leadership. In the rendering of service day by day, the responsibility to get the message through is accepted as a public trust: that too is the exercise of freedom.

All that has been achieved flows from the nation we serve. Under public regulation, the Bell System has generally been allowed the freedom it needs to perform its service well. It is essential that this freedom to serve be undiminished; that research and invention go vigorously forward; that new leaders be encouraged and prepared to lead; and that earnings be fully adequate to continue to pay good wages to employees, and a return to investors sufficient to attract and protect the billions of dollars of savings that make the service possible.

Through the years private enterprise and public policy in telephone communication have returned to the nation a value beyond price. We are confident they will do no less in the years to come. We are determined to meet the responsibilities entrusted to us, and we pledge our utmost efforts, always, in devotion to the public service and to the lasting security and advantage of the people of the United States.

From the A. T. & T.
Annual Report for 1950

Small Improvements Have Very Great Significance when Multiplied by the Vast Quantities Which the Bell System Requires in Serving Its 35,000,000 Telephones

The Big Little Things of Bell System Operation

Myrtus A. Davis

THE BELL SYSTEM'S telephone plant presents a large-scale paradox. For while it is being continuously renewed and improved and extended, never at any one time is there such a thing as a whole new model. Therein it differs markedly from many other physical elements of the American economy.

No normal year is complete without its announcements of the next year's even shinier automobiles. Refrigerators, television sets, sun lamps—all the gadgetry of modern living is changed from one year to the next. And since the new is always advertised as better, there is ever the implication that whatever it supersedes is—or is becoming—obsolete.

Not so this country's telephone equipment. You just can't trade in an entire telephone system for a new one.

What you do, instead, is constantly to invent and develop and improve and then, when what you have invented or developed or improved has been tested and found good, you incorporate it in or add it to the telephone layout. Perhaps, indeed, what you actually have is always a new model. It is, at any rate, continuously moving ahead.

In this process of steady physical improvement, there are two factors of major importance.

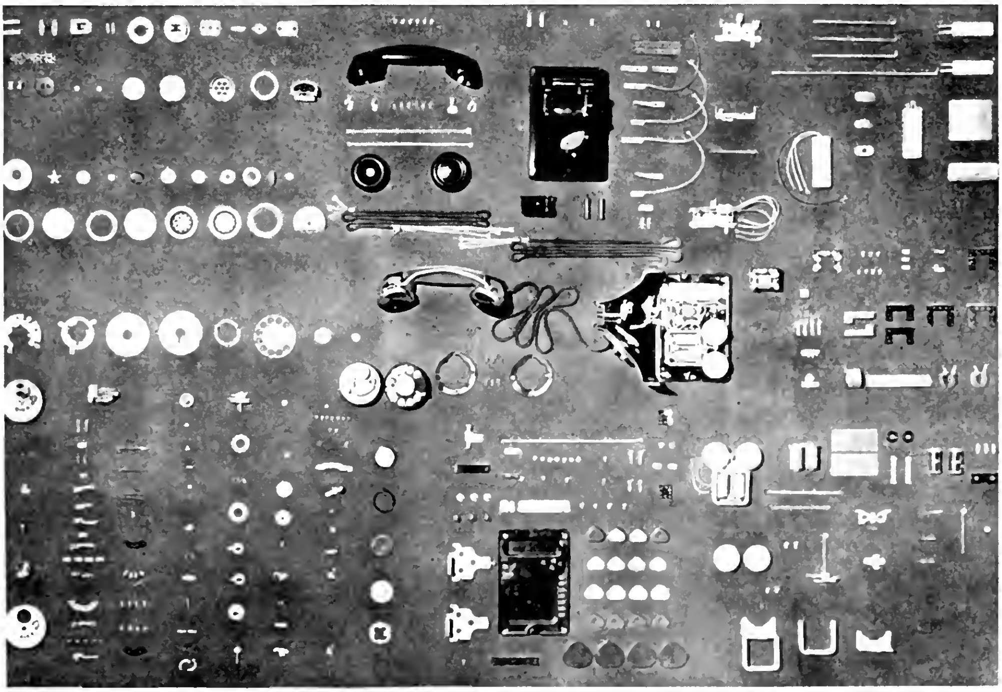
One is that every new or better item must work harmoniously with all the other plant now in service. It may be as radically different an invention as the transistor, which appears to be about ready to take over some of the duties and responsibilities of the vacuum tube and do them more handily. It may be in as straight a line of development as the newest type of telephone, which makes possible the use of smaller wires in telephone cables. But whatever may be the element developed or improved, each must be so designed that it will operate smoothly with the Bell System's ten billion dollars' worth of existing telephone plant.

The other factor is that of size, of immensity, of a sometimes almost unbelievable multiplicity of things. The Bell System is necessarily a big outfit. Some of the things it uses must be multiplied almost *ad infinitum*. No matter how small or seemingly unimportant some item may be, sheer numbers may make it big and important. That too is a consideration in physical improvement.

Drop Wire

Let us start our discussion of the bigness of little things with the matter of drop wire, one of the most commonplace components of telephone plant. Except in business centers, where most of the wires enter the buildings under ground, drop wire extends from the telephone pole to the house or other building, and is the connecting link between the wiring on the customer's premises and the open wire or cable running clear in to the central office. Drop wire originally consisted of two metallic conductors insulated with rubber and covered with an impregnated braid. Like any other object exposed continuously to the elements, drop wire inevitably suffered deterioration from nature's bombardment of heat, cold, sun, rain, snow, and sleet.

Since World War II, the Bell System has been using drop wire having rubber insulation covered with a neoprene jacket. It withstands the elements so much better that the rate



Little Things:—The 433 components of a Bell System combined-set telephone

This telephone installer is connecting a drop wire between the pole and the customer's house

the Bell System. They average 150 feet or more in length. Simple arithmetic tells us that any substantial increase in the average life of a drop wire means a good many thousand fewer drops to be replaced each year.

Moreover, deterioration may eventually mean failure of the service: a customer's line out of order, a repairman's visit. If the past five years had not seen such improvement in drop wires and in block wires (serving a somewhat similar purpose under like conditions), there would have been about 500,000 more cases of "trouble" last year.

Better service for the customer and economy of plant go hand in hand here.

of deterioration is greatly reduced. The new neoprene-covered drop wire wears so well, in fact, that not infrequently it is possible to use it more than once: i.e., to remove it from its original location when that telephone is disconnected and to run it again from pole to house for a new installation.

How important is such a change as better insulation on drop wires? Here your multiplication factor comes into play.

There are about 25,000,000 drop-wire installations now in service in

Protectors

SERVICE is brought to about two-thirds of the Bell System's telephones over aerial cable or open wire. Each of these installations includes a station protector, so called, the purpose of which is to protect the inside wiring and equipment from high currents or from excessive voltages from lightning, accidental contact with light and power circuits, or other causes. The protector consists essentially of two pairs of hard carbon blocks and two wire fuses.

Each pair of carbon blocks has between them a small air gap—about three one-thousandths of an inch. Normal telephone-line voltages cannot jump this gap, and so follow their usual circuits. But abnormally high voltage has no difficulty in jumping this gap and following a clear path to ground—putting the line temporarily out of service, but saving the equipment from harm.

Now, dust can get into this tiny gap; and dust plus some conditions of humidity occasionally combine to permit leakage of telephone current across the gap—and then the line is "in trouble." Introduced in trial quantities in 1947 and now being installed in substantial numbers, a pair of small cylindrical carbon pellets enclosed in a little capsule is replacing the rectangular carbon blocks—and is reducing the troubles due to dust and moisture by as much as 90 percent where high humidity prevails for long periods.

The fuses, of the cartridge type, consist of fuse wire in a fibre tube. The wire "opens"—melts—when a current well above the normal amperage passes through the fuse for any substantial length of time. Ordinary lead wire was used originally, but it frequently opened in response to changes in temperature and humidity. And again the line was "in trouble" unnecessarily. Long research and extensive field trial produced a

The earlier type of station protector, shown at the left, was equipped with rectangular carbon blocks (foreground) placed in the center of the base and enclosed in a plastic cover. The latest type of protector, at the right, employs much smaller cylindrical carbon pellets (foreground) enclosed in a metal capsule fuse wire—an alloy of lead, antimony, and zinc—which is far less likely to cause needless service interruptions and yet has the desired electrical characteristics.

Neither of these troubles would be likely to happen to a particular protector installation very many times—if ever. But with between twenty and twenty-five million protectors in service, even a small percentage could cause annoyance to a good many subscribers and send a good many repairmen to investigate the situation and fix the trouble. The newer designs are reducing substantially the number of both troubles.

Inside Wiring

The wire path between the protector and the telephone is commonly known as inside wiring, and for many years has consisted of two-conductor or three-conductor twisted wires. While these have always been installed as inconspicuously as possible,* their average life has not been long, for they are frequently ripped out, after the telephone has been removed, either in the process of redecorating or for some other reason. The resulting loss is not only the wire but the cost of installing it. And since there are millions of such occurrences in the course of a year, the loss aggregates millions of dollars.

For the last few years, increasing use has been made of a smooth jacketed wire which not only looks better but which can be applied to baseboards, walls, and other surfaces with a hand-operated stapling machine. This combination provides a more permanent as well as a more

* Except when raceways within the structure provide concealment for the wires.

The installer is using a hand stapling machine to fasten jacketed inside wiring attractive wiring installation, and it is much more likely to be left in place when the telephone is disconnected. The Bell System normally uses 800,000,000 conductor feet of inside wire in a year, and currently about half of it is of this jacketed type. What this use of stronger wire and the tendency to leave it in place mean in savings of wire and labor is self-evident.

On top of those advantages, the stronger wire and the tougher plastic jacket give the installation increased mechanical strength and reduce wire troubles. The reduction in troubles due to this new type of wire and new method of attaching can be expressed thus: a "trouble" rate in 1950 equivalent to the 1947 rate would have meant about 600,000 more cases than actually occurred last year of service failure and of consequent visits by repairmen.

Transmitter and Receiver

The gateways through which the subscribers' voices enter and leave the telephone network are the transmitter and the receiver. The transmitter has been described as the valve which regulates the waves of electricity in accordance with the pattern of the sound waves set in motion by the speaker's voice. The operation of the standard transmitter depends on the variations in resistance of a path through carbon granules with changes in pressure between the granules influenced by the sound waves on the transmitter diaphragm. These varying electrical currents proceed along the telephone wires until they reach the receiver at the other end of the telephone hook-up. Here the situation is reversed. The varying currents from the telephone line affect the attracting force of the receiver magnets, causing a diaphragm to vibrate and become an electric mouth uttering sounds corresponding to those of the speaker's voice at the other end of the line. If either the transmitter or receiver gets out of order, the rest of the telephone system is not of much use.

Through design improvements in the size and shape of the transmitter chamber containing the carbon granules, in the physical characteristics of the carbon granules themselves, in the material used in the cores and permanent magnet and diaphragm of the receiver, and in other ways, the trouble rate for these instruments has been brought down to about one-sixth of what it was 15 or 20 years ago. The magnitude of the improvement in telephone service from this single cause may be calculated without any great difficulty when it is known that, despite so great a reduction, the number of "troubles" involving transmitters and receivers is still more than 350,000 a year.

Telephone Cords

The part of the telephone which ordinarily gets the hardest usage, and therefore requires the most frequent replacement, is the telephone cord. With the twisting, squeezing in doors and drawers, "doodling" when telephoning, chewing by household pets, and other manhandling which it receives, the cotton-covered cord seldom lived to a ripe old age. Careful laboratory study, life tests, and field trials have shown that telephone cords covered with a neoprene jacket will last several years longer than those with the textile covering. Today a very large majority of telephones being installed are equipped with the neoprene-jacketed cords, and over 80 percent of the 9,000,000 cords used annually for maintenance are also of this type.

About half the 70,000,000 cords in service are now of the neoprene-jacketed type. Due in large part to this, the cord trouble rate has decreased about 40 percent in the last five years. Also, the neoprene-jacketed cord is significantly more kink-resistant than the textile-covered one, and this eliminates the desire of subscribers to place "anti-kinking" devices on the cords. Many of these devices are causes of excessive cord wear and consequent troubles.

Contact Surfaces

In the design of the telephone set—as in many other parts of the plant—it was found desirable to use precious metal on the dial and switchhook contacts, which act as switches in opening and closing the electrical circuits. It developed, however, that no matter what material was used and how much effort was spent in keeping these contacts clean, a stray piece of lint or other foreign substance falling between the two contacting surfaces would prevent the circuit from closing and either put the telephone out of service temporarily or seriously interfere with its use.

The answer turned out to be "twin" contacts. A double set of precious metal contacts is provided at each switching point in the set; and, since there is very much less probability of both contacts being affected simultaneously, this relatively simple expedient has had a marked effect on improved service and naturally has resulted in fewer visits by repairmen.

Coördination of Central Office and Station Performance

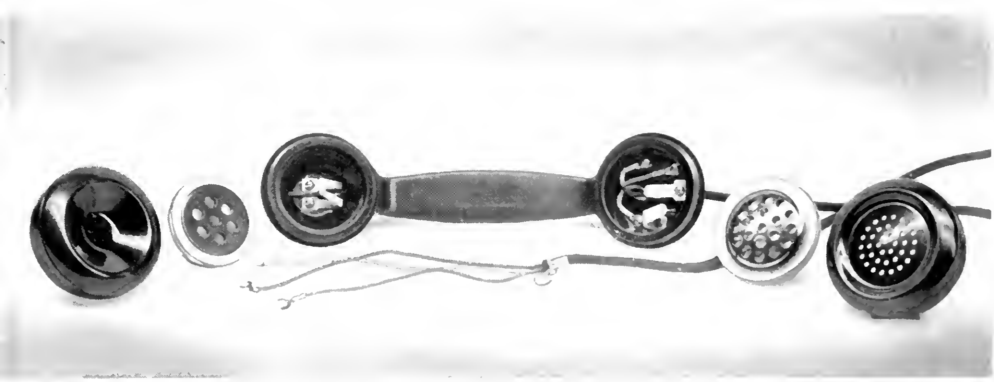
The importance of coördinating the design and operation of all elements of telephone plant, existing and new, into a harmoniously operating system was emphasized earlier in this article. This is very well illustrated in the case of dialing.

Each click of the telephone dial, as it spins back to its starting position, sends a pulse of current through some electromagnet in the central office equipment. The ability of central office dial equipment to receive the impulses from the telephone dial has been improved and extended, with impressive results. Twenty years ago, for instance, approximately one-third of all dial service troubles were attributable to telephone dials which were either too fast or too slow for the central office switches. In 1948—to take a recent year—only about seven percent of the dial troubles were associated with the speed of the telephone dial.

There are about 25,000,000 dial-equipped telephones in the Bell System. If this one aspect of dial service had not been thus improved, it would account for an estimated 100,000 more troubles a year.

The list could be continued, but the principle would be the same.

Not all the telephones in the Bell System are of the same type or the same vintage or the same method of



Here are the principal parts of the telephone hand set: receiver cap, receiver unit, handle, transmitter unit, transmitter cap, and cord

operation. But there are unifying standards which not only enable them to operate together but permit the application throughout the System of improvements which come from constant research, development, and test. And, as has been here demonstrated, even the "littlest" improvement can add up to big and important totals in terms of Bell System use.

The savings have been and are tremendously important. In view of the economic trend of recent decades, the "what might have been" without them is difficult to imagine.

The improvement in customers' service over the years is no less important, even though it seldom seems spectacular to the user. It is, nonetheless, proof of the System's policy of constant improvement.

What it all adds up to is another aspect of the job of giving the people of this country, come what may, the most economical as well as the best telephone service in the world.

Over forty-three million telephones now serve the people of the United States—double the number before World War II and 15 million more than five years ago. This enormous gain plainly shows the increasing part the telephone plays in our national life. It also demonstrates the conspicuous success of the telephone industry in furnishing good service at reasonable prices. In the performance of the industry as a whole, thousands of independently owned companies and systems operate nearly eight million telephones and make possible nationwide service through interconnection with Bell System lines. The continuing coöperation between the Independent organizations and the Bell Companies has been essential to the record of rapid growth and steady improvement.

From the A. T. & T. Annual Report for 1950

Associated Companies' Trend Surveys of Customer Opinion Tell Them Where They Stand With Customers, and Add Up to An Over-All Picture for the Bell System

Seeing Ourselves as Others See Us

C. Theodore Smith

Opinion surveys have been used in the Bell System for a good many years to help in the solution of service, market, and public relations problems. This article is a progress report on one of the newer uses of the opinion survey: to measure trends of customer opinion. It deals with the methods followed in these trend surveys, the kinds of information obtained, and some of the ways in which the information is put to practical use.

THE ASSOCIATED COMPANIES are now conducting opinion surveys twice each year, in the Spring and in the Fall, to find out how they stand with their customers. In the latest one, which they carried out this Spring, they obtained the opinions of more than 55,000 residence customers in about 750 of the communities they serve.

The sample of customers in each Company's territory, selected on the basis of accepted sampling procedures, is a cross-section of all residence customers served by the Company. People from all economic groups, those with dial service and manual service, and those with one-, two-, and four-party service, are represented in the samples, as are people from large cities, medium-sized places, and small towns. All these add together to give a picture of the Bell System as a whole.

The principal objective of these periodic surveys is to get factual information about what subscribers think of the quality of service, the cost of service, and the Telephone Company generally. Customers express their opinions by answering such questions as:

Is there anything about your service that is in any way unsatisfactory?

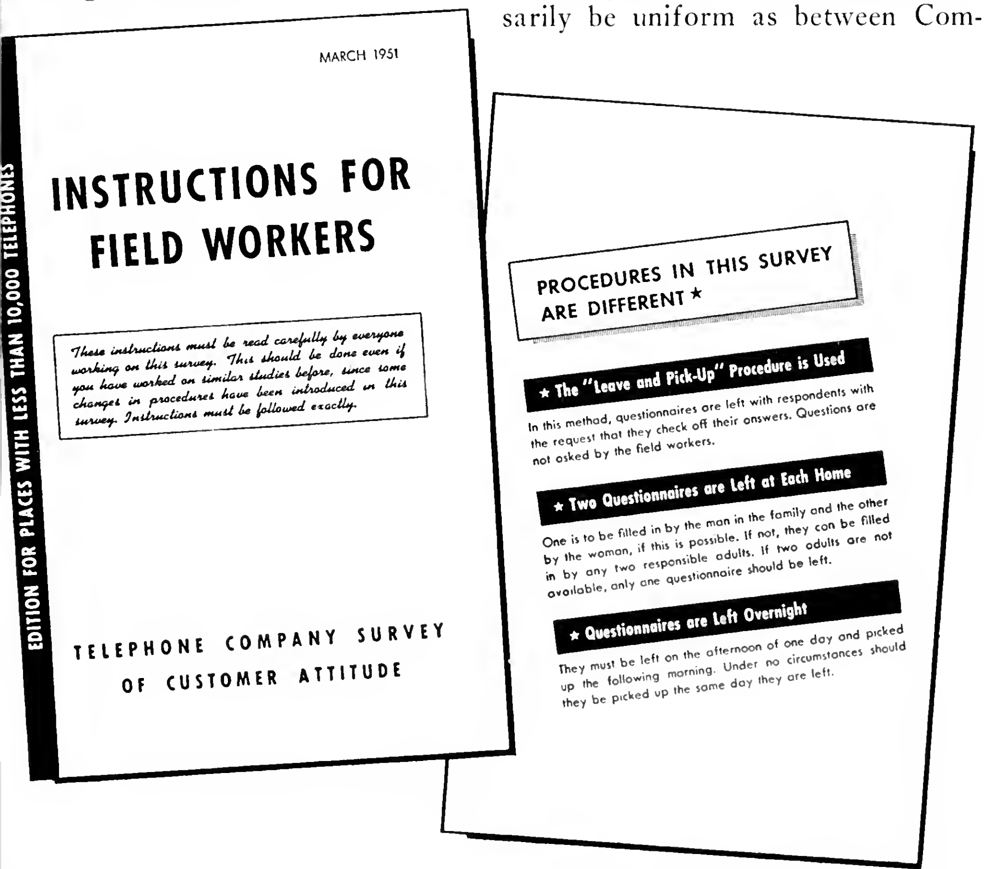
Do you feel that you get your money's worth out of your telephone?

What reputation do you feel the Telephone Company has in your community?

They disclose, too, something about iemselves: how long they have had ervice at their present address, how uch they use the telephone, whether ley use a telephone at a place of usiness, and whether they have iends who work for the Telephone ompany. And they also give inforation on the extent to which they ecall having seen telephone adversing in different media and on diferent subjects.*

The first experimental trend study was made in 1946 by the A. T. and T. Company, and was based on a System-wide cross-section of about 5,000 customers. No attempt was made to obtain results for individual Associated Companies. In succeeding studies, many of the Companies supplemented the Bell System sample in order to obtain representative results for their own territories. Since 1949, the Companies have been conducting their own trend surveys, with samples ranging from about 2,000 customers to considerably more in some of the Companies with Area or State organizations.

The procedure used must necessarily be uniform as between Com-



Field workers are supplied with a booklet describing the procedure to be followed

* Because of limitations of space, it has not een possible to cover specifically material on dvertising in this article.

panies and in successive studies, so that the trends will be meaningful for each Company and for the Bell System. To this end, a manual covering the various steps of survey procedure was prepared, and is used by the Companies in conducting the surveys.

How the Information Is Obtained

IN THESE SURVEYS, the Associated Companies obtain their information by the use of printed questionnaires. These are left with customers at their homes by field workers, with the request that they be filled in and left outside the door so they can be picked up. Questionnaires usually are left in the afternoon of one day and picked up the morning of the next.

The Telephone Company Would Like Your Opinion

We think you will enjoy answering the questions in this booklet, relating to telephone service and the Telephone Company.

Having your frank opinions will help the Company in its efforts to keep people informed about the telephone business and to provide the service they would like to have.

You can answer most of the questions by putting a check mark in the square ☑ opposite the answer which comes closest to what you think.

Please do not discuss the questions with anyone before you have filled in your answers as it is your own opinions that the Company is anxious to have.

We hope you will answer <u>all</u> of the questions. Please have the form ready so the interviewer can pick it up tomorrow, as arranged. You need not sign your name unless you care to.

1. About how long have you had telephone service at this address? — *Less than a year* ☐ *One to five years* ☐ *Over five years* ☐
2. Do you have dial telephone service? — *Yes* ☐ *No* ☐
3. Do you have a private line, or a party line? — *Private* ☐ *Two-party* ☐ *Four-party* ☐ *More than four-party* ☐

This is the first page of the questionnaire the field worker leaves with customers

This "leave-and-pick-up" procedure was adopted after considerable experimentation to develop a dependable and economical method of gathering opinion information on a trend basis where hundreds of widely scattered places and hundreds of different field workers would be involved. The field workers do not ask questions and record responses; their main functions are to enlist customers' coöperation in filling out questionnaires and to pick up the questionnaires when completed. While this calls for people who will make a good impression on customers, the job does not require extensive training of field personnel and can be carried out largely on the basis of written instructions.

It has been the practice, wherever possible, to leave two questionnaires at a home. Normally, the initial contact is made with the housewife, who is asked to fill in one of the questionnaires herself and to get her husband or some other responsible adult member of the family to fill in another one. In this way, both the man and the woman are given an opportunity to express their own individual opinions—and analyses reveal that adult members of the same family frequently have different ideas on telephone matters.

AS HAS BEEN the experience in other Bell System opinion studies, customers react favorably to being asked their opinions. Limited checks have been made from time to time, in which people have been asked whether they think this kind of survey is a good idea or not. Almost nine out of ten favor it.

Occasionally, customers write in

›mments about the survey in the ıestionnaire. Typical are the following:

"Happy to see you take the trouble to find out my opinion."

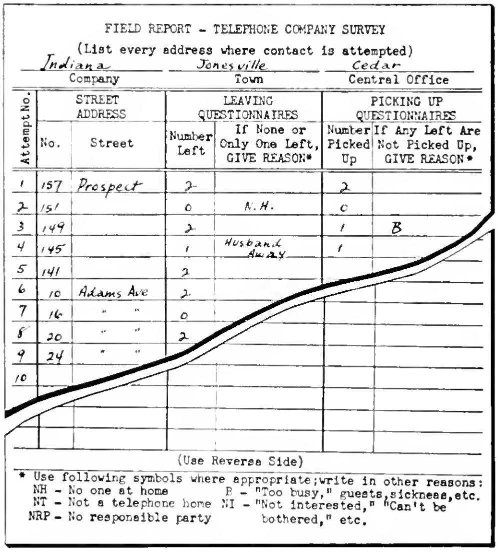
"I think this survey is a very good idea. You then know just how your telephone users feel and what improvements are needed most to satisfy them."

"This type of survey should be repeated from time to time to keep the company in touch with the public."

Unfavorable comments for the ıost part have to do with some speıfic feature of the study: a question ıhich the customer found difficult to ıswer, not leaving the questionnaire ›r a longer time, and so on. One ısband wrote: "Please don't leave ıestionnaires at my house—as my ıfe insisted I complete as per your ıquest."

S IN THE CASE of most opinion surıys, these trend studies are conıcted on a sampling basis. That is, sample of customers is selected in ıch a way as to provide a crossıction of all Bell System urban resiınce customers. This involves pickıg listings from telephone direcıries in a systematic way which gives ıery listing an opportunity of being ılected. The addresses for these ıtings (referred to as "key adıesses") are turned over to the field ›rkers and serve as starting points ›r specified routes which are to be ›llowed in making contacts.

Of course, the customers who will ı called on along the route starting ıom any one of the selected "key ıldresses" are not intended to be



FIELD REPORT - TELEPHONE COMPANY SURVEY
(List every address where contact is attempted)

Indiana — Company; Jonesville — Town; Cedar — Central Office

Attempt No.	STREET ADDRESS No.	STREET ADDRESS Street	LEAVING QUESTIONNAIRES Number Left	LEAVING QUESTIONNAIRES If None or Only One Left, GIVE REASON*	PICKING UP QUESTIONNAIRES Number Picked Up	PICKING UP QUESTIONNAIRES If Any Left Are Not Picked Up, GIVE REASON*
1	157	Prospect	2		2	
2	151		0	N.H.	0	
3	149		2		1	B
4	145		1	Husband Away	1	
5	141		2			
6	10	Adams Ave	2			
7	16	" "	0			
8	20	" "	2			
9	24	" "				
10						

(Use Reverse Side)

* Use following symbols where appropriate; write in other reasons:
NH - No one at home B - "Too busy," guests, sickness, etc.
NT - Not a telephone home NI - "Not interested," "Can't be bothered," etc.
NRP - No responsible party

An example of entries on a field report card

representative of all customers in the town or even in the general area of the key address. But by combining all of the groups thus covered in a Company's territory (or State or Area) it is possible to obtain a representative cross-section. As a check on this, the distribution of customers in the sample by type and grade of service is compared with the distribution of all customers in the territory each time a survey is made.

The field workers are employees of outside research firms specializing in market and opinion surveys.* Before starting on their assignments, field workers are instructed to get in touch with the local telephone company managers whose territories are involved, to tell them when and where they will be working. If questions come up during a contact with a customer, the field worker explains that she is not a regular employee of

* One Company in recent surveys has been using its own people.

the Telephone Company, and suggests that the customer get in touch with the local Business Office.

Each of the workers is given an instruction booklet which covers in detail the procedures to be followed. Field report cards are provided on which a complete record is kept of every attempt to obtain a filled-in questionnaire. This provides a basis for determining how many contacts are made, how many questionnaires are left, reasons why they are not left or not picked up, and so on. In some localities it may not be possible for the field people to follow the specified route exactly. The field report cards provide a means of determining the extent to which deviations from the prescribed route have occurred and, through field inspections or in discussions with the workers, to determine the causes.

The completed questionnaires are returned by the research agency to each of the Companies, where they are reviewed for completeness. The responses are then coded and punched on tabulating cards—one card for each questionnaire.* The statistical results of the study are obtained by mechanically sorting and counting the cards representing the completed questionnaires. From this information each Company completes its own report on customer opinion in its territory. Emphasis is on relative results: changes from one time to another, from one place to another, from one group to another.

The results, along with a representative sample of the tabulating cards, are also forwarded to the A. T. and T. Company. Here the material is consolidated into System totals, the data are analyzed from the over-all System viewpoint, and a report is prepared for general distribution. Here, too, emphasis is placed on relative results.

What the Bell System Learns From these Surveys

The better the public understand the Bell System and the more they like it, the more efficiently and economically can the business operate. In such a business, where good service depends so much on public understanding and coöperation, good-will is of more than usual importance. From the results of these opinion surveys, the System learns how its good-will account stands and finds out whether its balance is going up or down.

Here are some of the things revealed by survey results:

HOW CUSTOMERS FEEL ABOUT SERVICE IN GENERAL

Just as our service indexes and other operating measurements tell us how good the telephone service is from a technical viewpoint, the surveys give information on how good service is as the customer sees it. Because all the Associated Companies conduct the studies, such information is available about people living in different parts of the country and in communities of various sizes; about people with different kinds of service—dial and manual, one-, two-, and four-party; about people who have had service for different lengths of time; and about other groups.

* In reviewing questionnaires, a close watch is kept for cases where customers have written in comments or made requests which clearly call for some individual follow-up on the part of the Company.

WHAT SPECIFIC TROUBLES CUSTOMERS HAVE WITH SERVICE

In connection with certain of the juestions included in the questionaire, space is provided so that cusomers who feel their service is unatisfactory can write in their comnents and suggestions. Illustrative of the wide range of comments are he following:

"Children of the other party on the line play with the phone."
"Occasionally it takes quite a while to get the operator."
"They sometimes take too long to fix our line when it is in trouble."
"Clarify long distance bill; symbols sometimes confusing."
"Print in the telephone books is too faint and too fine."

This information, when properly ummarized, gives the Companies a retty clear indication of the things eople like and do not like about their ervice.

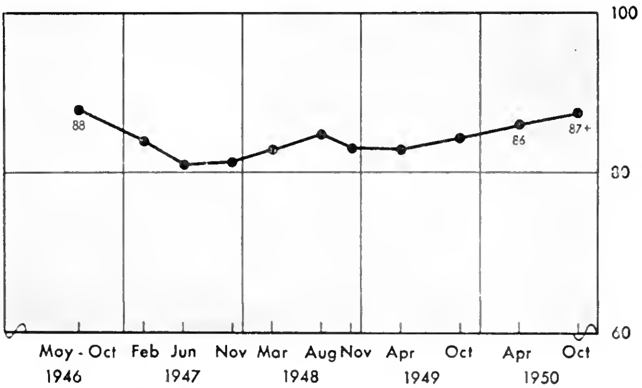
WHAT THE CUSTOMERS' STANDARDS ARE IN JUDGING SERVICE

The standards by which customers udge telephone service re by no means contant. They can and lo vary from place to lace, from time to ime and from different groups of customers. Through World War I, for example, attiude toward service ontinued to be quite avorable despite unvoidable declines in ervice quality as reected in the Company's technical service measurements. Further evidence that customer standards vary is the fact that individual-line customers complain of traffic service almost twice as often as do party-line customers served by the same central offices; this despite the fact that both are served by the same equipment or operators.

HOW CUSTOMERS FEEL ABOUT SERVICE NOT NOW COVERED BY TECHNICAL MEASUREMENTS

The operating departments' service measurements are made on a regularly scheduled basis in a great many of the cities and towns served by the Bell System; to cover all of these regularly would obviously be impractical. In the opinion trend studies, all types of localities are sampled each time a survey is made. The results, therefore, provide the Companies with considerable information as to how people feel about service in localities not covered regularly by the technical measurements.

Even in localities where service measurements are made on a regular basis, there are many aspects of that service which are not covered. These



The service attitude index reflects customer opinion of telephone service include, for example, such things as the frequency of occurrence of various types of party-line difficulties; certain features of incoming service—calls in error, ringing troubles, no one on the line, etc.; various types of transmission difficulties on local calls; condition and operation of the telephone instrument on the customer's premises; and difficulties with abbreviations on toll bills. The extent to which customers in the surveys mention such things, or fail to mention them, provides information on these unmeasured phases of service.

HOW CUSTOMERS FEEL ABOUT "OVERTONES" OF SERVICE

Perhaps one of the most important values of these studies is the evidence they provide of the effect of friendly and courteous service on customers' attitudes. Most customers feel that they are "always" or "usually" treated in the way they like to be treated by telephone people; and those who do feel that way—as compared with those who do not—are much more favorable toward service in general, toward the cost and value of service, and toward the company generally. Attesting further to the good impression created by friendly and courteous service are the many comments, such as the following, which people write in on their questionnaires:

"I like the long distance service I receive—operator is friendly, courteous, helpful."

"The courtesy extended by the business office is remarkable; it is always a pleasure to call about a mistake."

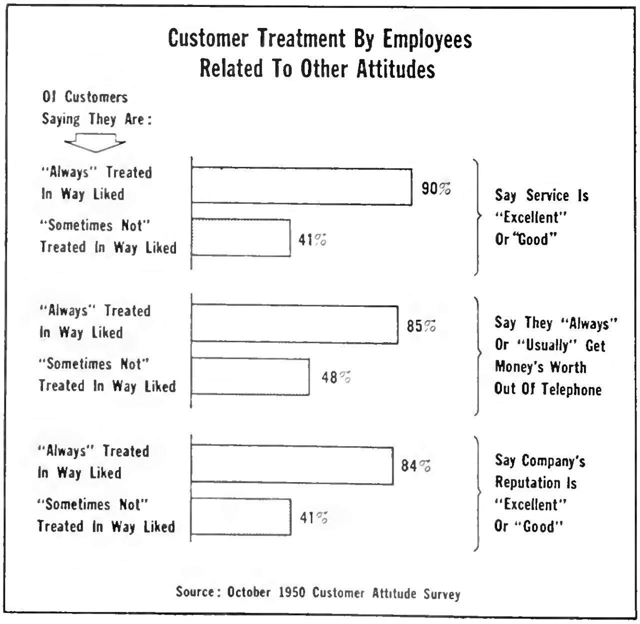
"Your service and co-operation during the hurricanes of '38 and '44 was positively amazing."

"Pleased with service and impressed with courtesy of your service men both in home and on highways."

"Prompt and courteous attention during service in Armed Forces at various locations in U. S."

HOW CUSTOMERS FEEL ABOUT THE VALUE OF SERVICE

These trend studies also provide the Com-



There is a marked relationship between friendly, courteous service and a good opinion of the Company panies with a means for keeping in ouch with public sentiment regarding the value and cost of telephone ervice. Questions are included in he questionnaire to find out whether people feel that rates are reasonable and that the Company is doing ll it can to keep down the cost of telephone service. Answers to other questions indicate whether people feel they get their money's worth out of the telephone, whether they consider it a necessity or mainly a convenience, and whether they are thinking of doing without their telephone.

HOW CUSTOMERS FEEL ABOUT THE COMPANY GENERALLY

The public judges the telephone business not only with respect to the quality and cost of telephone service but also on the Company's standing as a citizen of the community. In each survey, information is obtained as to what people think the Company's reputation is in the community, and about how well they think t is run, how well it treats employees, and how much it does to keep people informed about the business.

AN ADDITIONAL ADVANTAGE of these continuing studies is that they provide a vehicle for asking questions on special problems which may be of concern at the time a survey is made. So far, these additional questions have covered many different fields. They have been designed, for example, to find out how people feel about the job being done in meeting the demand for telephone service, how much they think they as customers benefit from telephone research, how much they know about the organization of the Bell System, what they consider the most important values and uses of telephone service, and many other subjects.

Indexes of Customer Attitude

THE INFORMATION developed in these studies has been used in constructing "indexes" of customer attitude. These provide over-all measures of attitude toward (1) the quality of service, (2) the cost of service, and (3) the Company generally. As has been true with the various operating indexes used in the System, revisions in these attitude indexes undoubtedly will be found desirable from time to time as more experience is gained in their use.

Each of the three major attitude indexes is based on responses customers give to a group of four or five questions. Early experience in Bell System opinion studies indicated that, to obtain a dependable measure of any of these basic attitudes, one question was not enough; several were necessary. These questions, taken together, constitute a "test" of the attitude of the individual, in much the same way that a series of examples can be used to test a person's ability in arithmetic. Obviously, the questions used as a basis of each index must have a common thread of meaning. They must give the customer an opportunity to express his opinion on the subject from a number of different angles. Some of the questions must be relatively "easy" to answer favorably, otherwise everyone is likely to get a low rating; and there must also be some questions which are hard to answer favorably, otherwise everyone would get a high rating.

Reports are prepared by the Companies showing results of the trend surveys

It should be emphasized that the attitude indexes based on the results of these surveys are not a measure of the job of any one department, group, or person. They show in relative numerical terms how the Company stands with its customers. That standing is the result of many things: of how good a job it does in supplying service when and where it is needed and at a reasonable cost, and of its efforts to render an accurate and pleasing service from day to day. It can be affected by off-the-job contacts of telephone people as well as on-the-job contacts. Things done to keep people informed on telephone matters and to build public understanding and good will can have an influence, as can also events outside the business entirely.

How Survey Results Are Put to Use

Because everyone in the telephone business has a hand, directly or indirectly, in shaping the public's attitude, the findings of the trend surveys receive rather wide distribution. Management and supervisory people see reports of results—and in a good many of the Companies they are circulated through division and district level in certain departments. Findings are frequently presented in both Bell System and Associated Company conferences of operating or public relations people. The surveys also provide material for the consideration of interdepartmental public relations and personnel committees, where such committees operate.

In some instances, first-line supervisors and non-supervisory people receive the findings through special reports, supervisory bulletins, or articles in employee magazines. More and more, the survey findings are being presented to these people—especially those whose duties involve contacts with the public—in group meetings so that they may be more fully interpreted and discussed.

How are the survey findings put to practical use to help in improving the customer's service or in increasing his understanding of service problems? This, of course, depends in large measure on what the results show; and the way in which they are used will vary, therefore, from period to period and from Company to Company. Here are some of the ways in which some or all of the Companies are finding the results of help:

In pointing out those aspects of day-to-day service customers receive which offer opportunities for improvement.

In spotting localities where service appears to be unsatisfactory; and in suggesting remedial action or the need for technical measurements as a further check on the survey results.

In determining the effect on customer attitude of service improvement programs, changes in operating practices, rates, etc.

In orienting and training contact employees—pointing out such things as the need for adequate explanations, for accuracy, and the great importance of friendly, courteous service.

As an aid in estimating the demand for better grades of service and in appraising the party line situation generally.

In suggesting opportunities for improvement in billing—to increase the clarity and accuracy of bills rendered customers.

In bringing to light the subjects it might be desirable to stress in various public relations activities, and in suggesting the best ways to present these subjects to the public.

In deciding on where and when public relations activities such as open houses, lectures and demonstrations, film showings, etc., should be held.

In evaluating the public relations aspects of broad programs of service improvement and expansion.

All of the Companies with State or Area organizations now have results available for these parts of their territories. (In a few instances, it is necessary to combine data from two successive surveys in order to obtain sufficiently large samples for this purpose.) In a number of Companies the trend survey questionnaire and procedures have been used as a means for getting opinions of customers in specific cities and even in individual central-office areas. The figures developed in this way—particularly when compared with those already available for the Company as a whole, or for a State or for a group of cities of similar size—are proving particularly useful in helping to evaluate operating or public relations problems peculiar to a given locality.

In applying any new technique for measuring opinions, problems of method are constantly being encountered—and this has been true in the case of the customer attitude trend surveys. All of the Companies are on the alert for such problems and must of necessity devote considerable time to finding solutions for them.

As important as it is to work out these methods problems, it is perhaps even more important at this stage to be sure that full advantage is being taken of the information developed through the surveys. That information holds a golden key to better meeting the needs and desires of customers. And only as the results are put to practical use will it be possible to realize the tremendous potential for good will which the knowledge gained from these studies represents.

ˋhe Foundation of the Bell System's Ability to Serve the Nation

Higher Wages, Taxes, and Other Costs Must Be Met by Increased Rates for Service

Today, on the heels of the greatest peacetime growth in Bell System history, the nation's defense effort is bringing a new and especially urgent tide of telephone demand. In these critical times, it is essential that the System be able to meet the nation's every need for fast, efficient, dependable telephone service.

The foundation of the System's strength to serve is its financial strength.

The key to its financial strength is sufficient rates.

But telephone rate increases have not been keeping pace with rising costs.

Take wages, for instance. Wage rates in the Bell System have doubled since 1939. The current annual cost to the Bell telephone companies of the *wage* increases they have made during the war and post-war years is ***nearly twice as much*** as the additional revenue they have received from *rate* increases in the same period.

And wages are the biggest single item in our cost of doing business. Wages take 63 cents of every dollar we spend for expenses other than taxes—a higher proportion than in most other industries.

So we haven't begun to catch up yet with our higher wage bill, let alone our many other increased expenses.

Taxes, too, have gone way up since before the war. Today they are our second biggest item of expense. Taxes cost the Bell System half a billion dollars last year and they are probably going even higher.

As wages and taxes have risen, so has the cost of nearly everything else we have to buy. Lead is up 228 percent, copper is up 112 percent, building materials 133 percent, paper 105 percent, to mention only a few.

These soaring prices have meant that the plant investment represented by each telephone added since the war has risen, on the average, to \$340. The average for all telephones in 1945 was \$254.

Compared with the rise in prices of most things, telephone rates have gone up very little—only a few cents per day per telephone. All the rate increases so far granted and pending average less than 25 percent of Bell System revenues. Yet, the price of food has risen 129 percent, clothing 96 percent, house furnishings 108 percent, and autos 93 percent. Telephone rates have gone up less than one-third the rise in the general cost of living—which has risen 78 percent since 1940.

Two-thirds of the more than \$4,000,000,000 of new capital the System has raised in the postwar period to meet the nation's telephone needs has had to be obtained in the form of debt (bonds). This has increased the proportion of debt in the System's capital from less than one-third at the end of World War II to about half today. This level of debt is much too high.

The fact that debt was low in 1945 made it possible for the Bell Companies to obtain, in a very short time, the enormous amounts of new money they needed to meet unprecedented service demands. The System should be no less well prepared for the future.

Most of the new money that will be needed to meet service demands should come from the issue of stock, either through bond conversions or otherwise. The complete conversion of the convertible debentures outstanding, together with the sale of the balance of shares which may be issued under the Employees' Stock Plan, would reduce the debt in the System's capital structure to about 37 percent. As a long range objective, the proportion of debt should be further reduced.

The ability of the System to do this depends upon the success of the Companies in getting sufficient rates. Applications for increased rates are pending in 28 states and other applications will be filed as the need arises. Rate-making bodies through the years have generally approved rates and earnings that have permitted good service, good wages, and a reasonable return to investors. We are confident that the same good sense and good results will continue to prevail.

The Vision of a Man Named Bell

Commemorating, on the Telephone Hour of March 5, 1951, the Seventy-Fifth Anniversary of the Invention of the Telephone, March 10, 1876

Announcer: On March 10th, 1876, seventy-five years ago, in the attic of the house at 109 Court Street, Boston, a little instrument of wood and wire and metal speaks. It speaks intelligible human words—and the name of the man in that room becomes immortal: Alexander Graham Bell, inventor of the telephone. And now—the vision of this man named Bell, narrated by WALTER HAMPDEN:

How does a man's dream begin? How does it grow?
It begins as a child begins—in simple faith and trust . . .
It wonders—as a child wonders . . . it dares to ask questions of the universe.
It expects answers . . . it finds answers . . .
In the tone of a plucked reed, quivering along a slender wire . . .
In the dance of the molecules across a metal disk . . .
Lifting a bridge of voices—
Across the deep silence of time . . . and space.
This was the dream of a man named Bell.

How does a man's dream grow? It grows as a nation grows—
Eternally leaping the horizons, calling others to follow—
Carrying the word—over mountain and prairie—
From the leather lungs of the ox-team driver—
In the mellow horn of the river boat men—
In the furious hooves of the dispatch rider—
In the roar of the iron rails! . . .
And as a nation grows, so does the need of its people . . .
The need to be close to each other—the hunger for the sound of a voice
Across that reach of time and space . . .
And the need is answered by the dream . . .

MAN

From Boston town to old New York the telephone wires are strung,
And westward to Chicago, the telephone lines are flung!
Across the plains the tall poles go—to link the whole durn nation—
Why, if this keeps up, we soon can talk—to everybody in Cree-ay-shun!

NARRATOR

Listen! Listen to the hum of the wires in the wind—
Across mountain and desert, valley and plain . . . do you hear it?
A nation is talking, a nation is growing—there! Do you hear it?
A voice from Minneapolis—and freight cars roll from Kansas!
A voice from Washington—and ships are loaded at a Western port!
Speak from Detroit—in Pittsburgh the furnaces roar
And the blinding metal races along the golden floor!

How can you measure the vastness of this man's dream?
What dimensions can you put upon it? . . . The answer lies—
Not in the words of tribute paid his memory—
Nor in the cold stone of monuments. His greatness echoes
In every word *you* speak—along the singing wires . . .

YOUNG MAN

Hello, Mom! It's a *boy*, and they're both doing fine!

GIRL

The train was late, but I'm OK, so don't you worry, Mother!

MAN

Ship ten more tons. The Navy needs it by next Tuesday!

WOMAN

Hello, doctor? Our baby's sick! Please won't you come right over!

YOUNG MAN

Yep, this army life ain't half bad—but I miss your good home cookin'!

WOMAN

Hello, Jim, this is your mother. Dad left us . . . just an hour ago.
His last words were of you . . .

NARRATOR

All the words of birth and death—of love and joy—
Of departing and arriving—of buying and selling—
Of asking and answering . . . all your words . . . all
Are the measure of this man's dream—its depth and breadth
Measured by your great need of it! How high its value? Only this.
Were not that dream fulfilled, time and space again
Would rush between us . . . and each would be . . . so much alone!

How does a man's dream begin? It begins as a child begins
In simple faith and wonder . . .
How does a man's dream grow? It grows as a nation grows,
Eternally leaping the horizons, calling others to follow—
And the others caught up in his vision—the builders, the planners,
The lineman against the sky—the girl at her switchboard—
The scientist charting the tides of invisible sound—
The splicer sealing the joints of the cable—
All are the weavers of speech serving the nation in peace and in war
Carrying the word—across the silence of time and of space—
Along the gleaming wires—all the words of love and birth and life—
Throughout all the land—to the farthest village and town—
And beyond the dark seas—and the endless horizons beyond the earth's curve—

This was the vision of a man named Bell—
And we are the inheritors of his dream!

A Social Evolution of Recent Decades Brings a Bell System Program to Meet Service Needs of City People Who Have Flocked to the Suburbs

Metropolitan Service for Suburbanites

Peter A. Dolan, Jr.

Editor's Note: Reversing a trend which had continued for more than a century, a social evolution of the past few decades has brought about a shift in the population away from rather than toward our American cities. Overcrowding alone could not have brought this about; but growing density of population plus improved transportation, the automobile and good roads, and the telephone could—and did. The Bell System has always adapted the form of its services to the changing needs of its customers, and the activities described in the following article, while unique in size and scope, are in general similar to programs which are in operation or planned in many parts of the System.

IN THE GREATEST single cutover in history, involving 3,450,680 telephones, the New York Telephone Company last May introduced its New York Metropolitan Area Service Plan.

New York City, southern Westchester, and Nassau County were joined in a single telephone area. The value and usefulness of service were increased immensely under the plan, which permitted a saving on many telephone bills and provided faster calling by establishing direct dialing between city and suburbs.

The history of this tremendous change in a telephone system goes back approximately twenty years and is intertwined with a social evolution which has altered the character of this great metropolitan area.

For many years the population of New York City has been spilling into the neighboring localities, with much of the flow going to the adjoining counties of Westchester on the north and Nassau on the east. As the suburban communities developed, towns and villages grew closer and their boundaries, in many cases, became mere lines on maps rather than economic or geographic separations. Better roads, bus routes, private automobiles, shopping centers, all drew them together. This new community of interest was reflected in sharp in-

Communication needs of post-war suburban residential developments such as this are met through the introduction of Metropolitan Area service

creases in the volume of toll calling and in many requests for broader local telephone calling areas.

Extended Area Service

HEEDING the desires of thousands of suburban users, the New York Telephone Company in 1936 introduced an optional service—extended-area. Under this arrangement, the customer, at a somewhat higher monthly rental, could obtain a larger toll-free calling area. For some years extended-area service met the requirements of suburbanites who sought wider primary calling areas. However, it was obvious that it was not a complete solution, for no matter how close suburban communities were drawn together by local development, they were tied as strongly to the city as they were to one another. The links of employment, friendships, business and professional acquaintanceships and amusement remained strong, and telephone people foresaw the day when the city and adjacent communities would be treated as a single metropolitan telephone area.

When World War II ended, the dam of the city's boundaries crumbled under the rush for housing. With city land scarce, the veteran in most cases had to leave the city for its environs, where home construction was booming. The migration of hundreds of thousands of residents to the suburbs during the post-war years was the climax of a social change that had started in the 1920s, and was the final touch in the creation of a metropolitan area encompassing New York City, southern Westchester, and Nassau.

A good deal of New York City is visible in this aerial photograph: Manhattan Island in the center, part of Brooklyn at the right, and some of the Bronx at the top

To bring the best service to telephone users in this area, the New York Telephone Company would have to make one of the largest changes ever attempted in any telephone system—and it was ready to do the job. It brought forward its New York Metropolitan Area Service Plan.

Making One Telephone Area

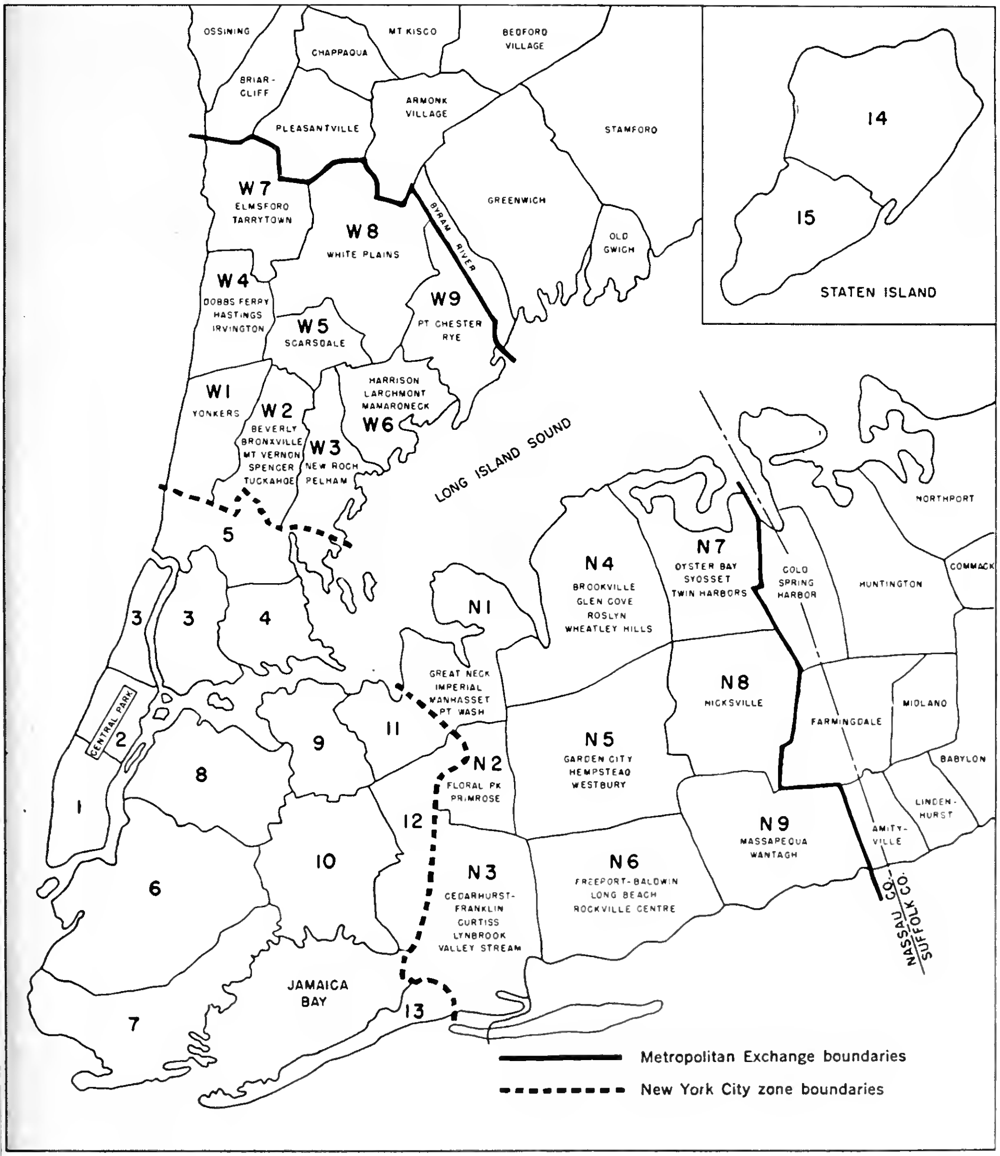
THE PLAN proposed the welding of the entire region into a single telephone area by:

1. Merging 46 suburban exchanges and the New York City exchange into a Metropolitan Exchange.
2. Providing direct dialing between most of the points within the area.
3. Broadening the primary calling areas of suburban subscribers.
4. Replacing toll billing of individual calls within the area with message-unit billing in bulk.
5. Extending the scope of the monthly message-unit allowance to apply on calls throughout the 46 suburban exchanges as well as on New York City calls.

The establishment of extended-area service in 1936 had indicated that telephone thinking was headed towards a metropolitan plan, yet the foundation for the plan was laid as far back as 1930. In that year all of New York City became a single telephone exchange of 15 rate zones, and toll charges within the city were replaced by message-unit charges up to three units for inter-zone calls.

The zoning system carried within it the origins of the metropolitan plan because it contained the possibility of extending the same system to the adjacent communities without disrupting the rate pattern of the city. In other words, why not divide the suburbs into zones and add them to the city's zones?

As traffic studies through the years



The 15 rate zones of New York City which form the basis of the Metropolitan Plan are shown within the broken lines at the lower left in this illustration—except for zones 14 and 15, representing Staten Island, out of location in the upper right corner. The Westchester and Nassau zones, preceded by the initials W and N respectively, extend to the heavy lines marking the present boundaries of the Metropolitan Plan showed a large increase in toll calls between suburban communities and between city and suburbs, the company in 1943 began active planning for the setting up of a metropolitan exchange. Committees were formed, analyses were made, and after three years a master plan was approved.

Nine Suburban Rate Zones

FUNDAMENTALLY, it divided southern Westchester and most of Nassau into nine rates zones each, similar to those in New York City, and it proposed a metropolitan exchange to include New York City and those suburban exchanges in Westchester and Nassau within a 25-cent toll range of zone 1 in the city (lower Manhattan).

After two years of further study and refinement, approval of the plan was sought from the New York Public Service Commission in conjunction with the Company's request for higher rates throughout its statewide territory.

However, before the plan had reached its final form, the Company began a program of changing about 40 central-office designations in the city to make room for additional offices and to eliminate the conflict in dialing codes between the city and suburbs. Twenty designations were changed to permit the suburbs to retain designations identical with community names. For instance, MArble 7 in the city was changed to LOrraine 2 because of the conflict with MAnhasset 7—Manhasset being the name of a community in Nassau County.

Most of the changes in central-office designations took place between July, 1947, and February, 1949. Never in the history of the Company had so many designations been changed in so short a period, yet serious complaints were practically negligible.

While hearings on the plan and the rate request were being conducted, a renovation of the system around New York was taking place in preparation for the day that the Commission would give the authorization to proceed. Changes had to be made in every central office—350—in the Metropolitan Area.

Message registration equipment, which automatically clicks off message units, had to be installed in the suburban dial offices and a major tandem addition was required for the handling of rerouted dial traffic. Although most of the central offices in the city had message registration equipment operating for calls whose initial charges were no higher than three message units, additions to the mechanism had to be made to record calls with initial charges of up to five message units. These calls were to be dialed under the metropolitan plan.

WITH suburban primary calling areas scheduled for enlargement, additional trunks were needed to handle the expected rise in the volume of traffic, and manual offices required more "B" switchboard positions.

For approximately one year this work continued, and by January, 1950, the system was physically ready for the change. However, an important question was unanswered—was the customer prepared for the change?

In the newspaper stories released in November, 1948, concurrent with the Company's filing for higher rates, an outline of the plan was included. However, 18 months were to elapse between the filing and the decision, and it could be assumed that the public had very little recollection of a metropolitan plan.

The institution of metropolitan service was dependent upon a favorable order from the State regulatory body. Since the Company schedule called for its introduction immediately, should such an order be obtained, publicity which normally would have been spread over months was to be crammed into a few days.

To fit a great variety of local conditions, 75 versions of a pamphlet describing the plan were prepared, 49 versions of a dial instruction card, 20 versions of rate schedules, 93 versions of a news story, 53 versions of a newspaper advertisement, and 7 variations of a radio spot announcement.

On Wednesday, May 10, 1950, the Commission approved the plan.

Last minute changes were made in the literature. The presses printed night and day. Company trucks shuttled between three printing firms and the company's accounting centers, transporting the reams of material to lines of clerks who mailed their way out of the paper avalanche.

Plant men worked through Saturday night and well into Sunday on the greatest cutover in telephone history. The "cut" involved countless technical changes and the connection of 5,300 trunks and the disconnection of 4,300 to permit the direct dialing of message-unit calls formerly routed through an operator on an A-B toll basis.

All central-office routing and rate material for operators was replaced with new instructions.

At 8 A.M. on Sunday, May 14, the

Photographing message-unit totals of the message registers is the first step in bulk billing of message units

Metropolitan Exchange went into operation.

Customer Acceptance

CUSTOMER ACCEPTANCE of the service was much higher than anticipated. The first returns demonstrated that the public was dialing 80 percent of the calls it should dial directly. Within a short time this percentage had risen to over 90 percent. It had not been expected that the 90 percent figure would be attained until a much later date.

Business office contacts, as foreseen, jumped sharply once the plan got under way. However, the plan was very favorably received, since most of the calls were from customers seeking advice as to the best type of service (message or flat-rate) for their needs, and asking explanations of the extent of their local calling areas. After the receipt of their first bills under the plan, many suburban customers requested information on the details of bulk-billing.

In operation for approximately a year now, the metropolitan plan has brought:

1. Savings to many customers.

2. Faster, simpler, and more uniform service, through the extension of direct dialing.

3. Greatly expanded suburban primary calling areas.

4. Reduced charges on many interzone calls.

5. A telephone service suited to the present needs of a widespread metropolitan area.

These improvements have added greatly to the value of service. For example, before the plan went into effect city customers were paying toll charges on calls to southern Westchester and Nassau whether or not they had used their basic allowance of message-units. The billing of these calls as message units was very helpful to the message-rate residence customer, for more than half of these customers were not using their full message allowance. The unused portion of the allowance now is applied to suburban calls.

Since the charge for message units exceeding the basic allowance proceeds on a downward sliding scale, many business customers have profited. They now make a number of calls to the suburbs at a lower cost than would have been possible under the previous toll charges.

Message-rate customers in the suburbs enjoy similar advantages on calls to the city or to other points in the metropolitan area, and flat-rate residence customers are able to call and be called without extra charges by more nearby communities.

ON THE COMPANY SIDE of the ledger, the installation costs of the plan amounted to several million dollars. However, the company was able to benefit immediately from some offsetting operating economies which the plan offered, and further savings are expected to accrue. Here are some examples:

Material savings have been possible in the accounting department, primarily because it is much quicker to process message units than it is to process toll tickets. This reduction in work has brought about substantial savings in salaries and wages. The force adjustments required were estimated carefully in advance and

Splicing in a new dial office in Nassau County to permit dialing to the city and to other points in the metropolitan area

were accomplished by reducing the hiring program. As a result, the normal losses from resignations, retirements, etc., produced the necessary reduction in the working force and no employees were laid off.

Similar savings have also been made in operator requirements, since calls formerly ticketed, timed, and completed by the operator now are dialed directly.

Also, in certain buildings savings in office space have permitted the company to install more central office equipment, thereby deferring building additions and line transfers.

Although metropolitan service, as a whole, went into operation as planned, the magnitude and complexity of the change made a few minor equipment and operating irregularities inevitable. On some routes, for example, traffic formerly merged with other tandem calls exceeded the estimates when routed directly, thus requiring an overnight increase in the number of direct trunks between the points affected.

In isolated cases, a sharp rise in the volume of calls to "call indicator" positions necessitated the prompt re-engineering of facilities.

Another problem that arose was the tendency of some customers to dial incorrectly the two-word central office designations such as White Plains and Port Washington. Many calls were dialed WP and PW instead of WH and PO. Newspaper advertising and the giving of dialing instructions by the local intercepting operators were used to correct these dialing errors.

However, from the broad point of view, the unexpected difficulties encountered were insignificant—not even comparable to the sand in the spinach.

The endless study of social trends . . . years of planning . . . mountains of detail . . . myriad equipment changes . . . made the New York Metropolitan Area Service Plan a success. But it was hardly in operation before Company engineers were looking into the possibilities of enlarging the new metropolitan exchange.

Taxes on Bell System telephone service in 1950 were about a billion dollars—some $200 million more than in 1949. The effect of the new Federal tax laws recently enacted will be to increase taxes somewhat further in 1951, due mainly to the higher corporation surtax rate. Currently, taxes are running at a rate of well over a billion dollars annually, and are equal to about $2.65 per telephone per month.

Federal excise taxes paid by customers in 1950, and remitted by the Bell Companies to the United States Treasury, came to about $500,000,000. Taxes levied on the Companies (and also borne by telephone users in the last analysis) were $499,451,000. While it is recognized that the nation's over-all tax needs should be shared by all sections of the economy, it is apparent that the users of telephone service are carrying at least their full share of the existing tax load. No service of like necessity carries a like burden.

From the A. T. & T. Annual Report for 1950

Test by Wreck and Storm

AT THIS CRITICAL MOMENT in its history, our country is peculiarly sensitive to evidences of its strength. Among its important physical assets must be counted a telephone service which is big, competent, alert, responsive—able to meet whatever test may come its way and to play its part in the security of the nation.* Recent occurrences which demonstrate how splendidly the men and women of the Bell System, backed by the resources of their nation-wide organization, rise to each challenge are, therefore, of special interest right now.

Two catastrophic railroad wrecks in the New York Metropolitan area, one on Long Island on November 22, 1950, and the other in New Jersey on February 6, 1951, which took a total of 161 lives and injured another 800 passengers, found telephone people prompt to do their parts both as individuals and as members of the Bell System team.

IT WAS on Thanksgiving Eve that two commuter trains, carrying 1,200 and 1,000 passengers, collided near Jamaica, L. I., and became instantly a mass of telescoped and twisted steel. Among the 77 who died were two Bell System people, and others were gravely or less seriously injured. Those who were able stayed in the cars or at the scene and helped those who were more badly hurt until rescue forces arrived.

An installer who lived not far away had gone home for supper and, turning on the radio, heard the first announcement of the crash. He left the table instantly and drove quickly to the headquarters of the police precinct in whose jurisdiction he knew the scene of the wreck lay. There he learned the gravity of the situation and saw police officers returning to headquarters to make oral reports because they had no means of communication at the site of the disaster. After checking the police lines, the installer raced to a Company garage, reported to his foreman by telephone what information he had about the disaster, and loaded a telephone car with telephones and wire. Then he proceeded to the wreck itself.

There he ran a wire to a terminal on a pole in the rear of an adjacent house and, having no time to wait for special central office facilities, asked the subscriber's permission to bridge an emergency telephone on his line. Within minutes the authorities thus had a telephone for their needs in summoning and directing vital help. Said one official, "Here we were figuratively out in the wilderness, needing a phone right there with us more than anything—and there it was; just as though it dropped from nowhere."

Meanwhile, other telephone men reached the scene with loads of equipment and set up additional facilities. Nine more customers released their lines so that emergency telephones could be bridged to them, and six mo-

* See "Bell System Well Prepared for National Emergency," MAGAZINE, Autumn, 1950; and "The Bell System's Number One Job," MAGAZINE, Winter, 1950–51.

bile radio telephones had been rushed to the scene.

When calls to the police first indicated in the central offices concerned that a disaster had occurred, operators immediately notified doctors, nurses, and hospitals in the vicinity. Then, as calls mounted to a flood, employees stayed on beyond normal hours of duty and others off duty came in until, within an hour of the wreck, there were 124 operators at their positions instead of the normal 50. They handled 82,000 calls between 6 P. M. and 11 P. M., in contrast with the usual 48,000.

Doctors, police, and newspaper men are reported in the press to have declared that they had "never seen such efficient service in such a short time."

And in New Jersey

It was less than three months later—on February 6 of this year—that a passenger train left the rails at a temporary trestle and plunged down a steep embankment near Woodbridge, N. J., with resultant great loss of life. Among the 84 who died were six Bell System people.

Here again the pattern was of individual initiative, of effective adaptation of facilities, of organized response to a great need.

The hour was a little earlier, and there were installers and repairmen at work in the vicinity. They hurried to the spot, a scene of horror and confusion, and plunged into rescue efforts and the first-aid work in which all telephone Plant men are trained. At this they were joined by other telephone men who had been on the train but were uninjured.

Flocking to the Rescue

From a home close to the scene went a call to the local central office giving word of the wreck, and the operators summoned rescue squads and notified the district telephone organization. The central office was only a few blocks away, and sent all its medical supplies and emergency equipment; and a little later still more was brought to the scene from the Company garage. Tarpaulins, emergency lighting equipment, and other heavy-duty material were of great use to rescue crews, and a Company truck was used as an ambulance.

Other men, meanwhile, undertook the difficult and essential task of providing communications for police, medical personnel, the Red Cross, and press agencies. Four telephones in residences nearby were borrowed for emergency use, and given central office priority, within minutes after the wreck. Soon wires were run to provide eleven more telephones at the scene. Still others were provided at the Red Cross emergency center, at the City Hall, and at police headquarters. Within an hour, the new circuits available totaled more than 30, and facilities to nearby communities had likewise been increased.

The 18 operators on duty in the Woodbridge central office were quickly joined by others anxious to be of assistance. In the eight-hour period following the wreck, about 150,000 more calls than normal were handled in central offices in the immediate vicinity.

So brief an account omits many aspects of the emergency telephone jobs

A nurse at the scene of the Long Island wreck summons more medical assistance

At the Woodbridge, N. J., Red Cross emergency headquarters, installers connect telephones in a hurry. Three of the four men in the background of this picture are telephone employees

and of the special services telephone people performed under ghastly circumstances. It must give, none the less, some over-all view of men and women who knew what to do in the face of bloody disaster, had the facilities and equipment to do it—and went right ahead and did it!

Winter dealt a heavy blow to large parts of the South

Telephone men, vehicles, and supplies came from long distances to meet the challenge and bring about a speedy restoration of telephone service

Storms Strike the South

A DIFFERENT but not unfamiliar kind of disaster has put the Bell System's capacities and recuperative powers to yet another test this winter; for the season's storms have been so severe as to be almost catastrophic.

The wintry gale which scourged the Northeastern States on last November 25 and 26 was the most violent of its kind ever recorded in that area.* More than 600,000 telephones were silenced, 3,200 toll and long distance circuits were put out of order, 129 central offices were temporarily isolated. And all—with a few exceptions in remote territory—were restored within a week.

That was a forerunner of the storm which struck the Southland before the New Year was more than well started.

For sleet, snow, and wind cut a swathe on January 31 and February 1 and 2 across parts of Texas, Louisiana, Mississippi, Alabama, and Tennessee with a force which left a nightmare in their wake. Sleet and snow are strangers in a good deal of that territory, and behind them they left 6,073 toll circuits out of service; 217 exchanges temporarily isolated, nearly 100,000 telephones "dead."

At once the forces of reconstruction were summoned. Crews were rallied, and were moved about to concentrate their efforts where the need was greatest. The Western Electric Company rushed in the required quantities of telephone plant and equipment and supplies. Distances are great, the lines are long. By the middle of February, half the damage had been repaired; by the end of the month, substantially all. It was a costly blow: an estimated $7,700,000 is needed to make it good.

Return Engagement

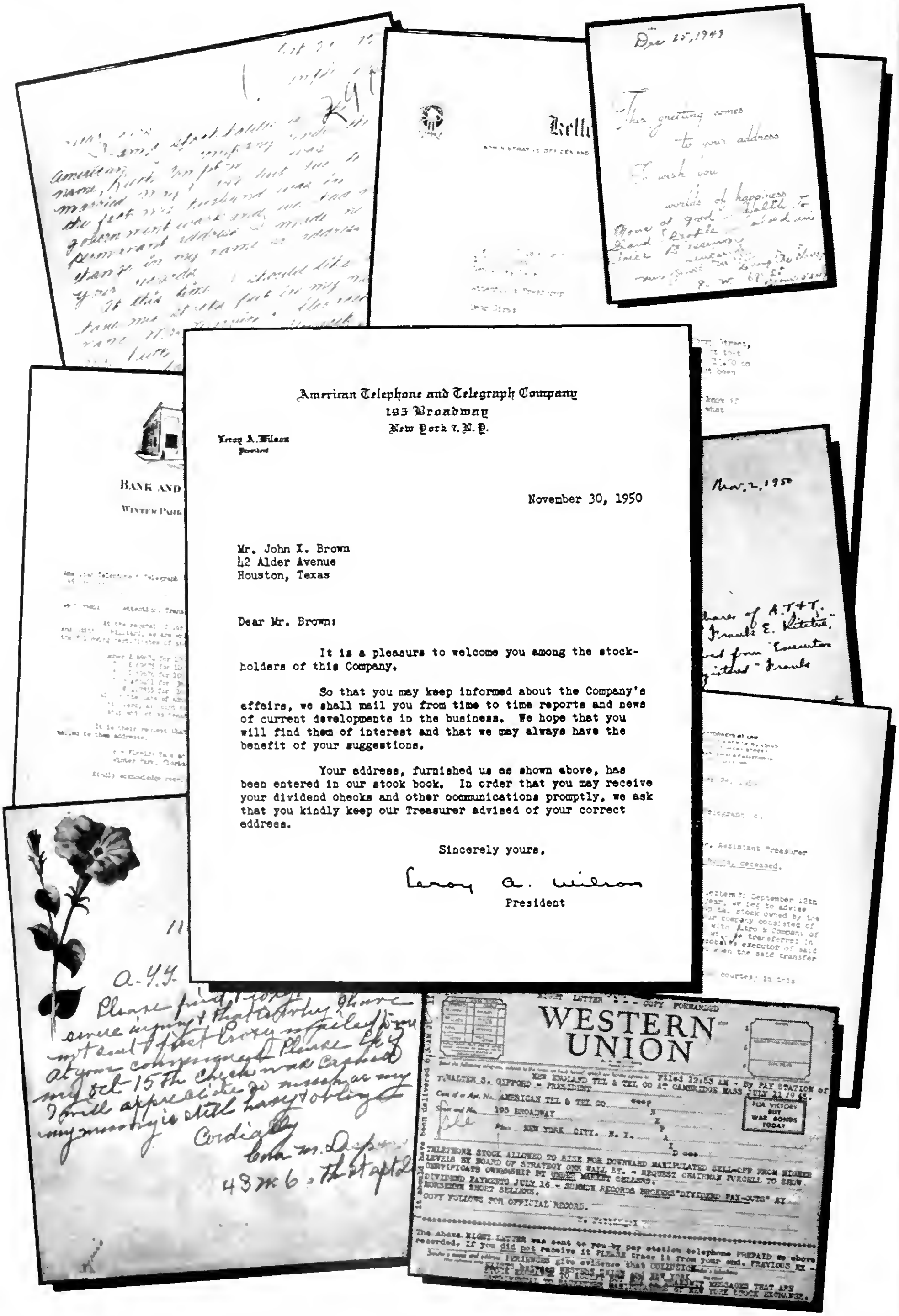
THEN NATURE played a joke—but it wasn't funny. For on February 13 and 14 more freezing rain and sleet came down: down across parts of Oklahoma and Arkansas and Texas; yes, even across part of the damaged area so recently restored to service. The score: 1,500 toll circuits silenced, 83 exchanges temporarily isolated, 6,000 telephones out of order. And again the transferring of repair and construction crews, Western Electric's fast shipment of needed supplies, the dawn-to-dark efforts which brought about restoration here by the end of February—to the tune of nearly a million dollars.

It isn't the damage that is the most important factor here. It is the Bell System's ability to restore it quickly, in stride. (Consider for a moment, as indicative of a certain recuperative power, some typical Western Electric storm emergency shipments through the end of February: 762,500,000 conductor feet of exchange cable; 28,788,000 linear feet of NP drop wire; 20,286 telephone poles.)

It isn't the cost—although it runs into millions—which is the most important factor, either. It is maintaining the System's financial strength, so that such losses cannot cripple it. For it is of utmost importance in these uneasy times that the Bell System's capacity to cope with these and even greater emergencies be unimpaired.

J. S. B.

* See "Bell Companies in the East Withstand Heaviest Blow," MAGAZINE, Winter, 1950–51.



American Telephone and Telegraph Company
195 Broadway
New York 7, N. Y.

Leroy A. Wilson
President

November 30, 1950

Mr. John X. Brown
42 Alder Avenue
Houston, Texas

Dear Mr. Brown:

It is a pleasure to welcome you among the stockholders of this Company.

So that you may keep informed about the Company's affairs, we shall mail you from time to time reports and news of current developments in the business. We hope that you will find them of interest and that we may always have the benefit of your suggestions.

Your address, furnished us as shown above, has been entered in our stock book. In order that you may receive your dividend checks and other communications promptly, we ask that you kindly keep our Treasurer advised of your correct address.

Sincerely yours,

Leroy A. Wilson
President

President Wilson's letter of welcome goes to each new owner of this business. Incoming communications—mail and telephone—average more than 15,000 a month

The Treasury Communications Bureau Handles 750 Special Contacts a Day; Stockholders Write and Call A. T. & T. On a Great Variety of Subjects

Human-Interest Aspects of Stockholder Correspondence

John K. Torbert

"It is a pleasure to welcome you among the stockholders of this Company." So writes President Leroy A. Wilson of the American Telephone and Telegraph Company in greeting each new owner. And sooner or later there are grateful replies, a typical one adding this touch: "I am aware that this does not read like a business letter, *but it is from a friend.*" On these two brief illustrations may be built a good understanding of the human side of stockholder relations.

Day in and day out, security holders telephone or write the Company, to make comments, requests, or inquiries. Rule One, of course, is to give each communication complete, prompt, and individual attention; and the representative of the Company in these security-holder relations is the Communications Bureau of the A.T.&T. Treasury Department.

There is drama in many of the messages received. Among the letters, we find lengthy ones, pathetic ones, and letters from owners of several hundred shares written on scraps of wrapping paper. There are impulsive letters, explosive letters and —thanks to a gracious providence— humorous letters! There is the occasional crafty letter attempting to pry loose information to which the writer is not entitled. There are civil letters and occasional uncivil ones, most of the latter from that fringe of humanity which finds life a sad affair.

With such a variety of mail, it might seem difficult to find a common denominator that is meaningful. The average stockholder is sometimes thought to be interested only in dividends and the market value of his stock. Experience with stockholder correspondence on a large scale, however, points to other interests that are also important. Most vital of all is the touch of individual human nature which lies in and behind every

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SUMMARY OF STOCKHOLDER CORRESPONDENCE, 1950

Type	*Total*	*Per Cent of Total*
Payment of Dividends and Related Work	66,996	35.9
Stock Transfers	33,724	18.1
Conversions of Bonds or Debentures into Stock	25,847	13.8
Other Bond Transactions such as Exchanges, Registrations, etc.	4,094	2.2
Purchase and Sale of Securities	2,932	1.5
Replacement of Lost and Destroyed Securities	4,677	2.5
Employees' Stock Plan	4,154	2.2
Handling Special Proxies for Stockholder Meetings	37,413	20.1
Miscellaneous (Stock and Bond Prices, Questions Bearing on Security Issues, Tax Matters, etc.)	6,644	3.7
TOTAL	186,481	100.0

as one can see from the accompanying summary of cases handled during a typical recent year.

It is impossible to match the extreme simplicity of many of the incoming letters, but our replies always try to express warmth and cordiality. All our answers are as personal, understandable, and pleasing as they can be made. We cannot claim to have developed a "style" of our own, but there is certainly little evidence of "gobbledegook." Our aim is clearly expressed in the request of a stockholder who once asked that we reply "in words an 8th grade student can understand, so I won't have to hire a lawyer to translate it." That our efforts have met with some success is evidenced by the following response—which is typical of many similar comments that have reached us:

"Please pardon me for asking these questions but I consider the A.T.& T. not only the best-managed Industrial in U.S.A. but also the one that furnishes more small services than any other company in the world."

Stock Transfers

THE BACKGROUND of intense human interest of the letters received is perhaps most apparent among those in the group listed in the table as "Stock Transfers." This is particularly true with those technically known as fiduciary cases—that is, when a stockholder has died and his administrator is functioning, or when a trust has been set up. It is necessary for us to inspect wills in most of these cases, in order to see that each transfer obeys the instructions of the decedent, and rarely does the character of a man come to light more conspicuously than in the making of his will.

We see wills that are brief and others that are small tomes. Some arrive in verse, many are hand-written, and one is reported to have been inscribed on the cuff of a shirt. The will that disposes of treasured heirlooms is always illuminating, and foreign wills submitted in duplicate in both English and the foreign tongue are formidable in every respect.

Sometimes we learn the origin of bequests. Two stockholders chanced to meet one day, and one stockholder asked the other what he should do with 100 shares of telephone stock he wanted to give to some worthy cause. Stockholder No. 2 suggested a memorial to the former's deceased wife, at the local social-service center. And, like a little acorn, a large and substantial growth followed. The fund has now accumulated enough money, we learn, to build a gymnasium for underprivileged children.

It is also necessary for us to inspect a great many death certificates in connection with transfers, and it may be surprising to learn that there is human interest of a sort in these otherwise unattractive bits of paper. These notices give us in the aggregate quite a different impression, in any event, from that of an Arkansas apple grower who once wrote:

> "Out of all the hundreds of thousands of stockholders you have, there must be a number of death notices reaching you every day, so it is no wonder you have to be exact. That would wear me to a frazzle. I'd rather gamble with war, worms, and weather on fruit crops and play tag with competitors any day. . . . But every man to his job, and every job to its man."

THE FUNCTION of our Communications Bureau in stock transfer cases is chiefly to request additional legal material, when needed, and to interpret—with the advice of our counsel—the intent of bequests, inheritances, trust funds, and the like, as far as they affect the transfer of telephone securities. Much of this meeting of minds is with lawyers and trust companies, but a substantial segment is direct with the stockholders or their survivors—usually those holding only a few shares. The Company's role with the latter is frequently almost as intimate as that of a family solicitor.

The outstanding human traits revealed in this type of correspondence are probably the thrift, foresight, and judgment which our stockholders demonstrate in great abundance. While some are more successful than others, their regard for their telephone shares—whether many or few—invariably seems to be high. The tone of our Bureau's service to the persons handling these estates must, therefore, reflect genuine respect for the lifetime achievements of the decedents. However, it is appropriate upon occasion to express a word of sympathy to the survivors—a gesture which is likely to be appreciated.

Dividend Correspondence

A MUCH MORE DYNAMIC atmosphere pervades the correspondence about dividends—our Bureau's largest single unit. Here the stockholder is very much alive, is interested in receiving and using dividend checks, and is likely to become upset if they are delayed.

Not all are as philosophic as the California lady who didn't mind waiting the required time for a duplicate, writing that "I am not going to let the T. & T. get me down when I have Bluebirds and Sweet Peas growing in my back yard." Mistakes and misunderstandings seem more dramatic in this field, and the quite human frailties of carelessness, absent-mindedness, and excitability are sometimes in evidence. In each dividend period, some 1,000 stockholders fail to notify us of recent changes of address, and their checks come back undelivered by the post office. Others who lose or accidentally destroy their checks get panicky, and the Company has to hold their hands, so to speak, until they calm down.

There is unending opportunity to make friends during the process of straightening out these difficulties, and many very appreciative letters resulting from our service are on file. A little more enthusiastic than the average, perhaps, but not too unusual, was the following note of thanks to the Company which arose from a small incident of this type:

> "I feel, as an inconspicuous stockholder, a definite loyalty and proprietorship in the Company. My stock is three generations old—most of it. That feeling may not seem important to you in your position but it is important. . . ."

Other responses have to do with corrections of addresses and titles. Minors, for instance, are quick to let us know when they reach the "noble age of 21 years" and ask us to remove the minor status from future checks.

One of our perennial "friends" is a railroad maintenance foreman with a foreign name, who apparently works only in the open seasons, from April through November, in the Middle West. He is seldom employed by the same railroad two years in succession, and is inaccessible while on the job. His checks accumulate, and once a year he "write to you very truly Im no work right now and have expenses just like an time. Wish you Mary Christmas and Good Year."

Another stockholder, living in a city which is division headquarters of an important railroad, wrote at great length to explain that the address we carried on our books for him was a number not actually in existence but which would have him "living right on the railroad tracks with trains coming along at 60 miles an hour."

Sometimes small differences in the spelling of names * cause the opening of unnecessary extra accounts, and the stockholders themselves, or their representatives, generally call this to our attention. "Clare H. Smith and Clare H. Smyth are one and the same person, having been our client for many years," wrote a lawyer, continuing: "Mrs. Smyth was for many years a widow of genteel Southern birth and don't you for a moment forget it, Suh!"

If one were to analyze this branch of stockholder correspondence in terms of its human characteristics, the qualities exhibited would probably turn out to be approval and enjoyment of the earnings of the business, a certain vivacity of viewpoint, and occasional demonstrations of temperament. All of these qualities give the Communications Bureau opportunity to render a personalized service, and it tries to fulfill the opportunity by answering each case as understandingly and rapidly as possible.

Bond Conversions

Since 1941, there has been a great increase in the amount of convertible bonds outstanding in the hands of

* Names used are fictitious.

This group of telephone specialists can handle more than 1000 telephone contacts a day

our stockholders, and for thousands of them these are the first bonds ever seen. A large majority, of course, handle their bonds properly and without trouble, but unfamiliarity leads others into many mistakes which roam far afield. Holders have been known to send us the entire bond with all coupons, merely to collect one coupon that is due. Many want to convert when they say "exchange" and exchange when they say "redeem." Such correspondence has to be handled in a spirit of understanding that combines both intuition and patience.

In addition to answering specific questions about the terms of a given bond, it often proves necessary to include some elementary instruction regarding bonds in general. The inquiries disclose varying degrees of bewilderment, and our replies must be factual, clear, and contain some salesmanship—trying to sell the idea that bonds are not "boobytraps," as one correspondent indignantly described them.

A reply to a modest bond conversion service of this type speaks eloquently for itself:

"The courtesy of a telephone call from the office of the Treasurer of the Company to a prospective purchaser of only six shares of stock—a person-to-person call from New York to St. Louis—is *big business*. As a minister of the Gospel with fifty-one years of service, I could wish that the Church might see the value and practice such art of public relations."

Since 1941, the Company has had four issues of debentures outstanding which have been convertible into shares of stock under certain terms requiring cash payments in various amounts. In the intervening years, there have been several occasions when the market prices of some of these bonds and of the stock created opportunities for the bondholders wishing to convert to sell their bonds and buy stock on the market at less actual cost than converting in the prescribed manner. During these intermittent periods, the Company called attention to this situation when such bonds were surrendered for conversion, and many bondholders were thus able to save considerable sums in individual transactions. The aggregate saving is not known, but it is believed to exceed $500,000, and benefited several thousands of our stockholders. This service has brought many expressions of appreciation, one bondholder thinking it "the finest display of public relations" he had ever known. Another, and one of the best, was:

"Your letter confirms the opinion that I long have had that not only is your concern well managed, but the management is Trustee-minded as far as the stockholders are concerned."

Replacement of Lost Securities

THERE IS one type of case which everyone would like to see completely eliminated: that pertaining to lost securities. The instinct to hide stock certificates, bonds, and other valuables in one's favorite mattress, bible, or mail-order catalog seems to be irresistible; such spots are much more attractive to many than a safety deposit box at the bank! The Company attaches a "Caution Slip" to new stock certificates, but despite this, literally thousands continue to be secreted in the old-fashioned manner.

It is inevitable, therefore, that a certain number of owners of the stock wake up some morning to find their securities missing. Then comes the distress call to the Company for a replacement—as though it were as simple as replacing a lost glove. But, fortunately, more than half the applicants find the missing papers before they go to the expense of a surety bond, which is the primary requirement before a replacement can be made. This happy outcome is probably often due to the Company's suggestion in all cases to search further and wait at least six months before taking action.

Most of the recoveries are made fairly promptly. But one case came to light in August 1950 that was 26 years old. As sometimes happens when a person moves, an old desk was cleaned out and the missing certificate—first noted as lost in 1924—was exposed once more to the light of day. The stockholder had never requested a replacement, but said that she had had a prolonged period of uneasiness and was now glad to regain her "peace of mind."

A bizarre experience which ended happily and cost no one any suspense or concern was that of a woman who had subscribed for $1,100 of convertible debentures of the 1949 bond issue. Shortly after she received the envelope containing her bonds, she went shopping for shoes, and tried on a pair at her local shoe shop. She did not buy these particular shoes, and they were restored to their box and replaced on the shelves of the shop. They must have been an unpopular size or model, as 13 months passed before the box was again opened—and there lay the envelope containing the $1,100 principal amount of bearer bonds! Meanwhile, the owner had moved peacefully away to another town without becoming aware of her loss. The local police department, which was called into the case, had to communicate with the Company to trace the owner.

There are always exceptions to the best of rules, and one request for replacement of A.T.&T. stock received only recently was because the certificate "was left in a safe that cannot be opened."

Bureau of Missing Stockholders

ONE OF THE unique developments in our correspondence has to do with the tracing of "missing stockholders." When any dividend checks are returned to the Company by the post office as undeliverable, the reason is

AMERICAN TELEPHONE AND TELEGRAPH COMPANY

195 BROADWAY, NEW YORK 7, N. Y.

To Stockholders:

Your stock certificate is a valuable paper. It is important to put it promptly in a secure place to prevent loss, theft or destruction.

A safe deposit box in a fireproof and burglarproof vault is an excellent place in which to keep this certificate.

In most cases of stock certificates reported lost, stolen, or destroyed, the loss would have been prevented if reasonable care had been exercised in their safekeeping. In securing new certificates to replace those which cannot be recovered, stockholders are necessarily caused considerable inconvenience, delay, and some expense.

D. R. BELCHER, Treasurer

A change in a stockholder's address should be reported promptly.

The Treasurer reminds stockholders that their stock certificates are valuable possessions

investigated promptly. Despite a very thorough effort to obtain a better address and make delivery, there are always a few stockholders who cannot be traced through the usual channels; and over a period of time these become assigned to a group of accounts which now number some five or six hundred names. These cases comprise a "missing persons" list, and we become almost a detective agency in tracing these lost people. The results have been not only gratifying but astonishing. One stockholder, for example, was recently located in a western city shortly after a brother in Maine had told us that "he said goodbye to his mother in 1891 and we haven't heard from him since." Since this work started, in the latter part of 1948, a total of 400 cases has been cleared up and checks having a value of more than $34,000 have been delivered to the rightful owners. The oldest case dates back to January 1925.

Proxy Mail

In April each year—and sometimes later in the year also if a special meeting is to be held—proxies are sent to all stockholders with the announcement of a stockholders' meeting.

The reaction to the proxy material invariably brings the Communications Bureau about twenty thousand or more messages for special handling. Many of these involve improperly executed proxies, which have to be returned for correction, but the most interesting part of this mail is known as "proxy comments." These communications ask searching questions about the telephone business, or about the subjects to be considered at the meeting.

Because they may have to include matters of general Company policy, the replies to the proxy comments must reflect the opinion and judgment of the executive management, and they are prepared under the close supervision of senior officers. The subjects cover as wide a range as the Company itself, and, as one would expect, extremes of both praise and criticism are received. By far the majority of the comments are, of course, favorable and complimentary. Few more sincere tributes have been received, for example, than this excerpt from a note from a stockholder who is not a telephone employee himself but who obviously was brought up in the best traditions of the Bell System:

"Growing from a teen-age piggy bank and sale of World War I Liberty Bonds, my holdings eventually reached that of the statistically average stockholder (31 shares). . . . But tonight I vote on actual issues and sign my proxy with a memory and silent tribute for my father, — — —, retired after 42 years and on a pension from — Bell until his recent death January 29th. Every x on this proxy is made as if he were over my shoulder and as, in his development of my character in younger years, he would want me to vote without saying so."

These letters, comments, and opinions—both pleasant and otherwise—represent the most outspoken communications which the Company receives from its owners each year, and they receive very attentive consideration. They come from a small fraction of the total stockholder family, perhaps, but when studied in perspective, year in and year out, they have been a healthy and constructive influence. All of the replies to these letters are very highly personalized.

Other Types of Correspondence

THERE ARE other types of correspondence with stockholders which, though small in quantity, arouse no little interest from the point of view of stockholder relations.

No matter how much the Company dislikes being involved in litigation, it cannot avoid being in the middle whenever the ownership of stock is the subject of a legal dispute. There are usually about a hundred cases of this kind going on, generally due to family squabbles and marital separations, over stock held jointly.

Contrasted with these comparatively few unhappy situations, the joint tenancy form of registration to provide survivorship, whose popularity has grown tremendously, is now used by more than 150,000 pairs of friends and relatives—presumably husbands and wives for the most part. On a percentage basis, therefore, our comparatively few unfavorable insights are far outweighed by the happy ones. Also, and among the happiest, never a day goes by without receipt of several notices from women stockholders that their names have been changed to something else preceded by "Mrs." What, they ask, does the Company want to do about it?

Special Services

ANOTHER interesting department of stockholder correspondence might well be described as that of special or collateral services.

Some of these one would naturally expect, such as supplying information for income tax purposes. We receive letters from stockholders every day asking for data which will help them establish a cost basis for their shareholdings; and shortly before March 15 each year, there are hundreds of requests for reports on dividend payments.

One would also expect to see requests from stockholders for admission tickets to the *Telephone Hour* radio broadcasts which arrive from time to time, for help in obtaining telephone service of various kinds, or for assistance in the purchase and sale of our securities.

There are other special services, however, which might be considered outside the regular line of duty; but if they can be handled without too much difficulty, they are usually undertaken, and bring a favorable response. Some of these include requests for odd bits of information, such as the following:

> "What I want to know is whether a person in a penal institution, or a baby, or an insane person that cannot write his name, can own stock in a company such as yours, as far as laws and company rulings are concerned. What caused these questions was a discussion, which in turn was caused by a woman's statement that she was going to buy a Government Savings Bond for a dog." *

As other examples, a number of French stockholders prevailed upon us shortly after World War II to arrange shipments of much needed articles from New York department stores, using their accumulated dividends to pay for them; and a man requested us to forward a letter which resulted in his locating a long-lost brother—a stockholder—from whom he had been separated for 25 years. We got credit for the reunion!

Stockholders' Names

THERE IS, too, the charm of the varied names we cannot avoid examining and momentarily pondering over. Every letter has a name or two, and there is a thrill—to note how often the name of a writer is about what one might expect for the case in hand.

There are names from all known foreign origins; there are English, American, and Biblical names; there are the Scandinavian names one would expect affixed to letters from Minnesota; Central European names in the steel producing areas; and good German names from Wisconsin. One sees an occasional woman stockholder with the given name of "John," as they have it down in Carolina, and plenty of women "Willies" and "Frankies" and "Georgies" in Texas. There was the instance of the Carolyn Laundry, which was inadvertently addressed as "Dear Miss Laundry." And occasionally some of the "Carols," "Evelyns," or "Marions" who are men resent being addressed as "Miss." It was one of those who wrote us:

> "I tank you very much for the dividend check I received this morning but please let me tel you that I am a *man not* a *woman*, and I would greatly appreciat if you change that mistake, thank you."

The Letter-Writers

VARIOUS METHODS are employed for handling stockholder correspondence, and of course these are the subject of constant study. Continuous efforts are made to assure the genuinely personal treatment that our stockholders have come to expect as owners and customers of the Bell System. Because of the large volume of letter writing required, various well known devices are adopted for

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* The answer to such questions is *yes*, provided there is in each instance a properly authorized legal representative.

speeding production. Certain statements or paragraphs, for instance, can be used in many different letters. All of the correspondents are instructed, however, to use these only as foundation material, and every correspondent is encouraged to vary letters to meet the individual situations.

Our discussion would be incomplete without a word about the correspondents themselves. The backbone of the force consists of employees with many years of experience in handling correspondence with stockholders. Most additions in recent years have been graduates of women's colleges who majored in English or Economics and they have been quick to respond to their training. In general, the standards are exacting, and the more able the correspondent, the more the work will absorb his or her full powers and capacity. In 1669, a book was published in England about the qualities with which a "Compleat Solicitor" should be endowed* and its precepts fit so remarkably the qualities desired in a good correspondent that they are worth summarizing briefly here, adapting the choice phrases of the original as much as possible:

First, he ought to have a good natural wit.

Secondly, that wit must be refined by education.

Thirdly, that education must be perfected by learning and experience.

Fourthly, and, lest learning should too much elate him, it must be balanced by discretion.

Fifthly, to manifest all these former parts, it is requisite that he have a voluble and free fluency to utter and declare his concepts.

The Future

As THE NUMBER of stockholders increases, one may be sure that the correspondence will grow in quantity. Simple expansion, however, should not be the principal thought when trying to anticipate what may lie ahead in this field. Nobody can predict what the equity owners of American business may be facing, but one thing may be definitely relied upon: whatever changes and developments may occur, the correspondence relationship with stockholders is here to stay and will grow in its usefulness and importance.

If it be true (as many believe) that business leadership is a public trust, and that it has a duty to support the economy which has resulted in our standard of living, the correspondence relationship between management and owners is a very important strand in the life-line or unifying principle of the system. It is possible to develop a very responsive formula in support of this principle, a sort of "stockholder relations quotient" with which to encourage the success of good stockholder correspondence. This formula was expressed for all time by William Shakespeare, when he proclaimed:

One touch of nature makes the whole world kin.

* "*The Compleat Solicitor*" of 1669 (second edition, 1683), reviewed in "Confessions of an Uncommon Attorney" by Reginald L. Hines, 1948.

Twenty-five Years Ago in the

Bell Telephone Quarterly

Items from Volume V, Number 2, April 1926

The Telephone's Fiftieth Birthday

In recognition of the 50th birthday of the telephone on March 10, 1926, many congratulatory communications were received at the headquarters of the American Telephone and Telegraph Company. The following telegrams were of particular interest:

Ft. Myers, Fla., March 10, 1926.

Walter S. Gifford, *President*
American Telephone and Telegraph Company,
195 Broadway, New York.

Founded on science and great business sagacity the march of the telephone has been steadily onward and upward to the stupendous success of the present day. The end is not yet. I heartily congratulate the company and its personnel on the celebration of its Golden Jubilee.

Thos. A. Edison.

New York, March 10.

Thomas A. Edison,
Fort Myers, Florida.

We greatly appreciate your kind message of congratulation. Your unique position in the field of science and invention gives to your generous commendation of telephone progress greater weight than could come from any other living American, and encourages us to accept the grave responsibilities of future development and growth.

Walter S. Gifford.

March 10, 1926.

Mr. Thomas A. Watson,
Passagrille, Florida.

We remember today with feelings of deep appreciation that on March 10, 1876, there was spoken into the telephone the first complete sentence ever transmitted by electricity. It was Alexander Graham Bell who spoke these words and it was you who heard them. Bell was the first to speak through the telephone and you were the first to hear. The instruments were invented by Bell but they were made under his direction by you, with your own hands, and you ran the first telephone wire over which these words were carried. This historic sentence was spoken in a room at 5 Exeter Place in Boston. The wire transmitting these words was less than fifty feet in length extending only to another room in the same building. On that day the personnel of the Bell System consisted of but two, Dr. Bell and yourself. Today, March 10, 1926, hundreds of thousands of members of the Bell System, including our connecting companies, throughout the United States are celebrating this historic achievement of which you are now the only survivor. From their hearts there goes out to you today the words of Bell when he spoke the historic first sentence, "Mr. Watson, come here; I want you." On behalf of the men and women of the Bell System I send you on this, the fiftieth anniversary of the telephone, congratulations and best wishes.

W. S. Gifford.

St. Petersburg, Fla., March 10, 1926.

W. S. Gifford, *President*
American Telephone and Telegraph Co.,
New York, N. Y.

I am very grateful to you for your kind telegram of today and thankful that I was chosen by the fates to be the associate of Alexander Graham Bell in his wonderful work and happy that I may call myself one of the splendid body of men and women who have made of Bell's invention an instrument of such tremendous service to mankind.

THOMAS A. WATSON.

From "Notes on Recent Occurrences"

The Aurora Borealis

ON THE MORNING of January 26th of this year (beginning between ten and eleven o'clock eastern standard time) difficulty was experienced in operating the grounded telegraph circuits over a part of the United States and Canada. This was true of the circuits of the telegraph companies and railroads as well as to those of the Bell System. At once the report went out that an aurora borealis was in progress. It was broad daylight, so of course no aurora was seen, but the erratic behavior of the circuits was easily identified with that which years of observation have shown to be usually associated with auroral displays. Whether there actually was an aurora on the day in question will probably never be known because the earth currents which are the direct cause of the erratic behavior of the telegraph lines sometimes appear without the accompaniment of any luminous display in the northern sky such as the term aurora calls to mind.

It is not frequent, to have a display of this sort so extensive as to be severely felt in both Europe and North America. However, one of the most extensive as well as powerful auroras occurred within the memory of all of us—May 14–15, 1921. This display was brilliant both in Europe and America and the accompanying earth currents were sufficiently severe, not only to cripple telegraph service for the time being but to burn out heat coils and char the paper insulation of cables where these contained grounded circuits. The foreign potentials observed on telegraph circuits in some cases attained momentary values as great as 500 volts. . . .

Engineers of the Bell System have been collecting data for some time on effects produced by meteorological disturbances, particularly in connection with earth potential differences and radio transmission.

In the study of earth potential differences, the direct current telegraph circuits of the Bell System which connect widely separated points afford a means for obtaining data. Many practical difficulties arise, however, such as ground potential disturbances caused by the operation of trolley lines, leakage from conductors to ground which vitiate the accuracy of measurements. Furthermore, when the aurora disturbances are most severe, the first duty of the test board forces is to restore the service on any lines which are affected by it. Many observations have been made, however, in accordance with a prearranged schedule. The results obtained have yielded considerable information as to the characteristics of earth potential differences during such periods of disturbance.

In long distance radio transmission, the observations which have been made by Bell System engineers indicate that meteorological disturbances sometimes have an important effect. Data have been obtained indicating that certain relationships exist between effects produced by magnetic storms and radio reception.

What more significant data may become available in the future it is not possible to predict. Nevertheless, through continuing measurements of earth potentials and radio-transmission phenomena, the Bell System engineers have an opportunity to supply valuable data and give material assistance in the study of those factors being investigated by the cosmical physicist.

From an article of the same title by Robert W. King

ie XXX · Number Two Summer 1951

B + T

MAGAZINE

rican Telephone & Telegraph Company · New York

Who's Who & What's What

in This Issue

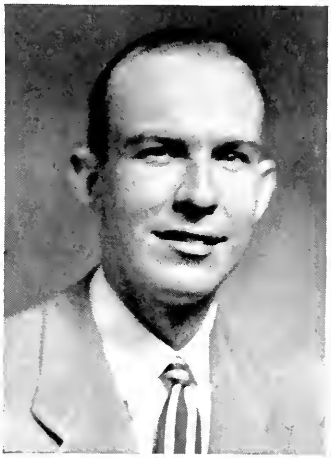
A Lieutenant (J.G.) in the overseas transportation service, U. S. Naval Reserve Force, in World War I, Harvey W. Roscoe joined the Accounting Department of the New York Telephone Company in 1920—and still keeps up his celestial navigation as a hobby. In 1925 he transferred to the A. T. & T. Treasury Department, and five years later moved to Long Lines headquarters, where for the next fifteen years he was in charge of its Treasury Department. Since 1945 he has been assistant treasurer, Stock Division, of the A. T. & T. Treasury Department. He is a member of the American Society of Corporate Secretaries, and of the executive committee of the New York Stock Transfer Association. During the post-war period of Bell System financing, Mr. Roscoe has been directly concerned with eleven A. T. & T. bond issues totaling about two and three-quarter billion dollars. During the same period, the number of A. T. & T. shares outstanding has increased from about twenty million to more than thirty million, and the number of stockholders has grown from about 675,000 to the total he discusses in this issue.

It is a sad commentary on the state of the world that Donald S. Bridgman's last previous contribution, "For Heroism, Gallantry, or Extraordinary Achievement" in World War II, was published in this Magazine for Autumn 1944, and now, less than seven years later, he writes about the participation of Bell System people in another conflict. Starting with the Ohio Bell Telephone Company in 1920, Mr. Bridgman transferred to the A. T. & T. Company in New York a year later. Since then, in the Personnel Relations Department, he has been concerned with technical and staff employment and related personnel matters. He continues the interest in the Signal Corps Affiliated Plan which prompted his "Skilled Manpower for the Signal Corps" in the Magazine for Sep-

Harvey W. Roscoe

Donald S. Bridgman

Emma W. Condit



Stuart R. Trottmann, Jr.

Charles W. Hadlock

tember 1943, and has other contacts with military people. Recently his activities have included arranging for inspection or study of the Bell System by visitors from other countries who are here as part of the Marshall Plan or other government programs.

JOINING the Traffic Department of the Chesapeake and Potomac Telephone Company of Virginia in 1934, EMMA W. CONDIT transferred a year later to the New York Telephone Company. There she held assignments as service representative, coach, and business office supervisor in the Commercial Department of the Manhattan-Bronx-Westchester Area. Since 1947 she has been a member of the training group in the Commercial Division of the A. T. & T. Department of Operation and Engineering, where she is principally concerned with business office supervisory training.

TWO YEARS AFTER STUART R. TROTTMANN, JR., became a member of the Public Relations Department of the Bell Telephone Company of Pennsylvania as a copywriter, in 1939, he left to enter the Army as a private. Four and a half years later, Major Trottmann was honorably discharged and returned to Philadelphia and the Public Relations Department there. Early in 1947, he transferred to the Information Department of the A. T. and T. Company in New York. Here he has served successively in the several Divisions —most recently in the Advertising and General Information Division. Among his assignments has been the study of the many factors which contribute to the rôle of Bell System people as good citizens and good neighbors in their communities.

THE BELL SYSTEM career of CHARLES W. HADLOCK began when he joined the Long Lines Plant Department in 1905. He transferred to the Traffic Department a few years later, and has served there in various supervisory capacities. The first Traffic Control Bureau was opened in 1925, in Chicago, and Mr. Hadlock opened it. He has been closely connected with the Bureaus since that time, has been responsible for the development of a great part of their methods and practices, and is thus ably qualified to tell us about how they operate—and why.

LEROY A. WILSON
1901–1951

PRESIDENT LEROY A. WILSON DIES

LEROY A. WILSON, President of American Telephone and Telegraph Company, died in New York City on June 28, 1951. He was fifty years old.

Mr. Wilson was elected President of A. T. & T. on February 18, 1948, a few days before his forty-seventh birthday. An engineer by training, he had previously risen to the post of Financial Vice President. It was under his leadership that the Company and its Associated Companies in the Bell Telephone System successfully carried forward their tremendous financing and telephone service expansion program of the last few years.

Born in Terre Haute, Indiana, Mr. Wilson was educated in Terre Haute schools, and graduated with honors from Rose Polytechnic Institute as a civil engineer in 1922. As a boy, he had a newspaper route, and later obtained additional money for his education by summer work in mine surveying, bridge designing, railroad and highway construction, telephone installation, and other jobs. On graduating from college, he went to work for the Indiana Bell Telephone Company as a clerk and student in Indianapolis at a salary of $110 per month.

His rise in the telephone business was steady. He became district traffic chief for Indiana Bell in 1923, first in Muncie and then in Terre Haute, and by 1929 he had served as district traffic superintendent in Marion, Fort Wayne, and Indianapolis. In that year, he accepted a position with the American Telephone and Telegraph Company in New York, where he worked first on telephone traffic and dial equipment engineering problems. Later he transferred to commercial work, and after heading up groups assigned to telephone directory and telephone rate matters, in 1942 he was placed in charge of the entire Commercial Division of the Department of Operation and Engineering. He became a Vice President of the company in 1944, and Financial Vice President in May of 1946.

When Mr. Wilson succeeded Walter S. Gifford as President, three and a half years ago, his election was widely hailed as a conspicuous example of the recognition given to outstanding ability in the American business enterprise system. He himself said that success was not to be measured by the rank attached to a job, but by capacity to think, understand, and act. He was a tremendous worker himself, could penetrate quickly to the essentials of a problem, and at the same time was able to exercise unusual patience in the handling of complex matters.

Mr. Wilson was intensely interested in the growth in number of A. T. & T. stockholders, and last May presented stock certificate No. 1,000,000 to Mr. and Mrs. Brady Denton during impressive ceremonies before several hundred employees in the assembly room of the headquarters building in New York.*

He was a member of Lambda Chi Alpha fraternity and of the engineering honorary society of Tau Beta Pi, and had long been interested in fraternity affairs. He was an officer of the National Interfraternity Conference from 1938 to 1944, and served as chairman of the Conference in 1943–44.

Mr. Wilson was a director of the Chase National Bank and the Metropolitan Life Insurance Company; a member of the Board of Managers of Rose Polytechnic Institute; a trustee of Denison University, The Carnegie Corporation of New York, the East River Savings Bank, and Grand Central Art Galleries.

He was awarded the honorary degrees of Doctor of Engineering by Rose Polytechnic Institute in 1948, and Doctor of Laws in 1950 by Hamilton College.

He was a member of the University and Links Clubs in New York, and the Short Hills Club in New Jersey. His home was in Short Hills, New Jersey.

Surviving are his wife, the former Blanche L. Willhide, of Marion, Indiana, a daughter, Shirley Ann, and his father, Garrett A. Wilson, of Brazil, Indiana.

* *Excerpts from his address of welcome to the Dentons are given on page 78.*

CLEO F. CRAIG IS ELECTED A. T. & T. PRESIDENT

CLEO F. CRAIG was elected Pesident of American Telephone and Telegraph Company at a meeting of the Board of Directors on July 2, 1951, to succeed Leroy A. Wilson, who died on June 28.

Mr. Craig was born in Rich Hill, Mo., in 1893, the youngest of seven children. At the University of Missouri, he maintained a high academic standing, won a varsity letter in basketball, and graduated in 1913 as a Bachelor of Science in Electrical Engineering. He was a member of Tau Beta Pi, engineering honorary society, and of Eta Kappa Nu, professional electrical society.

His Bell System career began shortly afterwards, when he went to work as an equipment man, at $15 a week, in the St. Louis office of the Long Lines Department, which operates the Bell System's long distance lines. Twenty-seven years later, in 1940, after progressing through a variety of responsibilities in the Middle West and East, he was elected Vice President in charge of the Long Lines Department—the organization with which he had started in 1913.

Mr. Craig was elected Vice President in charge of A. T. & T.'s Personnel Relations Department in 1941, serving in that capacity until 1948, when he was named to head the Department of Operation and Engineering and the Revenue Requirements Division. A year later, he was elected Vice President in charge of Finance and Revenue Requirements, and in 1950 assumed additional duties as head of the General Service Department.

He is a director of the A. T. & T. Co. and of several of the Associated Companies, and is a member of the Long Lines Board. He is also a director of the Citizens First National Bank & Trust Company, of Ridgewood, N. J., and the National Safety Council. He is a trustee of the Central Savings Bank, New York, and a member of the corporation of the Presbyterian Hospital, New York.

Mr. Craig is a Fellow of the American Institute of Electrical Engineers. He is a member of the University and Links Clubs of New York.

Mr. Craig in 1914 married Laura Heck of Rich Hill. They live in Ridgewood, N. J., and have three children: John H., Laura E. (Mrs. Harry Kirkwood), and Robert F.

CLEO F. CRAIG

President, American Telephone and Telegraph Company, 1951

Purchase of A. T. & T. Stock Certificate No. 1,000,000 By Mr. and Mrs. Brady Denton Exemplifies Distribution Of Ownership Among People in All Walks of Life

A Million Stockholders—An American Milestone

Harvey W. Roscoe

WHEN President Leroy A. Wilson of the American Telephone and Telegraph Company signed A. T. & T. stock certificate number One Million, on May 15, 1951, and handed it to Mr. and Mrs. Brady Denton, new joint stockholders, this act represented the passing of a milestone in American business.

A corporation with a million owners had appeared on the American scene.

What brought this about?

It would be less than a full explanation merely to point out that the A. T. & T. Company has long been the nation's largest corporation, and that it has had the most stockholders because it has needed the most capital.

There is more to it than that.

Our search will carry us into the rise of the corporation in the American economy, the present stature of that economy, and the investment potential of the nation, before we arrive at a consideration of the character of the American Telephone and Telegraph Company itself.

The Rise of the Industrial Corporation

WHEN Alexander Graham Bell was conducting his telephone experiments in the garret of a Boston rooming house in 1875, the business corporation as a form of industrial organization had scarcely come of age. We were still largely a nation of small shops, family-owned enterprises, and farms.

But the beginnings of the corporation were far back in our earliest Colonial times and the days of the joint stock * trading companies which built

* The term "stock" came into use from the Dutch word "stocc," a stick of wood. Evidence of ownership was afforded by the practice of splitting a willow stick along an edge scored with distinctive markings. The investor retained one half and could prove his interest by matching his "stocc" with the half held by the company.

To Discharge Our Public Duty Well

Excerpts from the statement of President Leroy A. Wilson at the presentation of A. T. & T. stock certificate No. 1,000,000 to Mr. and Mrs. Brady Denton, of Saginaw, Michigan

In the United States, more than in any other country, large numbers of people own their nation's industries. Under this wide private ownership we also have by far the greatest industrial production that any nation ever had.

A million people own the American Telephone and Telegraph Company—and under this ownership our country has the best telephone service in the world.

I have often pointed out that the growth of the Bell System has been made possible by the savings of the many, rather than the wealth of the few. The reason is obvious. No small group of people have enough money to supply all the capital required to make our telephone service what it is. Without the savings of the many, it would be literally impossible to build all the lines and switchboards and other physical facilities that are needed.

To say this another way, the reason why we have more and better telephone service than any other country is that that is what this country wants—and a million Americans have had the faith and enterprise to buy into it . . .

Widespread ownership puts the spotlight on another duty, also. That is the duty of management. When people buy shares in industry, they are expressing their faith in management. Management must justify that faith.

You, Mr. and Mrs. Denton, of your own free will have entrusted part of your savings to us. Of your own free will you can withdraw from this business whenever you wish. This freedom that you enjoy gives the greatest possible impetus to our efforts. We must continually strive to hold your regard and confidence. We can only succeed in your eyes if we succeed first of all in rendering the telephone service this nation needs and wants. And to that end, we must keep this business always a place of opportunity for able men and women who will render top-notch service as telephone employees.

So your trust in us inspires us to discharge our public duty well. It encourages and promotes fair treatment of telephone employees. It places on us the responsibility for seeing to it that your savings are protected for you and your children, and that you receive a reasonable and steady return on your investment. The money you have put to work must also work for you.

We accept those obligations—all of them. I do not imply that our obligations would be different, or that we would feel differently about them, if the American Telephone and Telegraph Company were owned by only a thousand stockholders instead of a million. I do say, however, that in a business owned by a million people, it is impossible not to realize these responsibilities to the utmost. It is this sense of responsibility—it is the full awareness and acceptance of trust and obligation—it is this and only this, in a free society, that makes it possible to build and operate a business of this size in the first place.

President Leroy A. Wilson of the A. T. and T. Company presents stock certificate No. 1,000,000 to Mr. and Mrs. Brady Denton, of Saginaw, Mich., at a ceremony in the assembly room at Bell System headquarters on May 15, 1951. The Dentons' two older sons, John and Brady Jr., look on

up the merchant empires of England and Holland in the 17th Century. When our new Republic took its place among the family of nations, corporations were a minor part of its economy.

By the year 1800, some 335 business corporations had appeared on the American scene. These were mainly undertakings having a direct public interest: the construction of turnpikes, bridges, and canals; water supply, fire protection, dock facilities; and banks and insurance.

By this era, also, man had learned to use the energy in steam. Power tools and machinery were being created to replace the muscle and sweat of animals and men. This was the source from which was to come the efficiency of large-scale production. The growth of large-scale production called for increasingly larger amounts of capital. The corporate form of business organization was well adapted to meet that need.

The corporation had other values as well. The investor limited his liability to the amount of his stock ownership, rather than placing his entire personal fortune at stake, as is the case of individual proprietorship or partnership. And, with the development of security markets, the stockholder could sell his shares readily when he wished to.

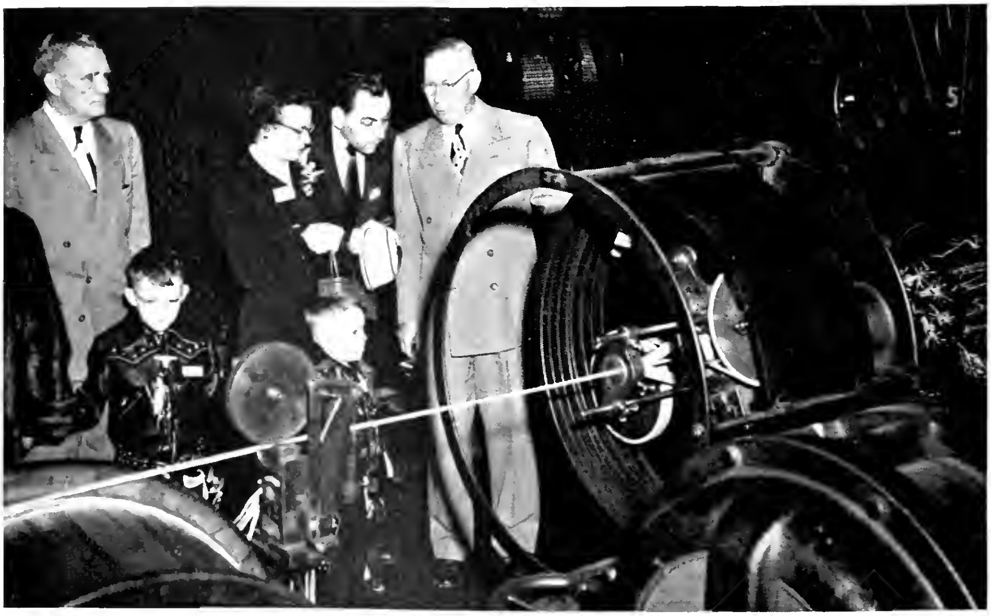
Corporate development in the manufacturing field started in the textile industry in the early part of the 19th Century. The next significant expansion came with the formation of the railroads. The New York Central, Pennsylvania, Baltimore and Ohio, and Erie systems came into existence in the middle 1800's.

The decade following the close of the War between the States brings us to the birth of the telephone. In the centennial year of our Republic, our economy, recovering from the War between the States, was gathering strength for an expansion which would have taxed the imagination of even the most far-sighted. Bell's generation and the next were to live through an era of economic expansion unparalleled in history.

This era saw the harnessing of electricity to man's needs for light and power; the development of the automobile industry and the vast extension of improved highways; the realization of man's age-old dream of flight; and the growth of entire new industries based on oil, gas, and the application of chemistry to common raw materials. It was this expanding economy which provided the background for the development of the Bell System.

Where the Money Comes From

THE BELL SYSTEM has to be big, because it serves a big nation. And only a big, sound, prosperous country could provide the wherewithal—the capital—to create a public servant able to serve all its homes and places of business, cross its plains and scale its barriers from ocean to ocean and from palm to pine, contribute vastly to its military security, and forge forward in progress without halt.



The Denton family inspects a cable stranding machine at the Kearny Works of the Western Electric Company. Works Manager R. F. Clifford (left) and Cable Shop Superintendent T. M. Erickson act as guides

The One Millionth Stockholder

When Brady Denton and his wife, Dorothy, of Saginaw, Mich., jointly purchased seven shares of American Telephone and Telegraph Company stock one day last Spring, they became together and quite unwittingly the one millionth stockholder of the A. T. & T. Company. And *it* became, by the same token, the first corporation to be owned by a million stockholders. The event was hailed throughout the nation, and the Dentons were welcomed by the company of which they had become part owners.

Brady Denton, 33 and a World War II veteran, is an automobile salesman, and he and Mrs. Denton live in a pleasant small home in Saginaw with their three sons, Brady Jr., 6, John, 3, and Robert—who was born last Winter. To receive their stock, Mr. and Mrs. Denton went to New York with their two older sons last May, as guests of the A. T. & T. Company. There, on May 15, President Leroy A. Wilson signed Certificate No. 1,000,000 and handed it to the new owners in an impressive ceremony in the headquarters auditorium which was attended by several hundred employees.

Mr. and Mrs. Denton were introduced by Hartley J. Cansfield, Saginaw manager of the Michigan Bell Telephone Company. After accepting the certificate, they received long distance calls of congratulation from Mayor William R. Hart of Saginaw; Mrs. Nina I. Schuler, chief operator at Saginaw; and Miss Ethel Barstow Howard, of Pomfret, Conn., who has owned A. T. & T. stock for 70 years—one of the longest periods of ownership on Company records.

The morning ceremony was followed by a luncheon, also at headquarters, given for the Dentons by A. T. & T. officers; and that evening Mr. Denton was the guest of honor at a dinner at which the principal speakers were Charles E. Wilson, Director of Defense Mobilization, and Arthur W. Page, a director and former vice president of the A. T. & T. Company.

During the rest of the week, the Dentons were guests of honor at a reception and luncheon at the New York Stock Exchange, and visited a number of Bell System installations. These included the Kearny Works of the Western Electric Company, the Bell System's manufacturing and supply organization; the headquarters of the Long Lines Department, which provides long distance and overseas telephone service and networks for carrying radio and television programs; and the Bell Telephone Laboratories, the world's largest industrial research center.

On Saturday, May 19, the Dentons boarded a plane for home. They had had unusual opportunities to see some of the plant and the operations of the company of which they had suddenly become the most celebrated stockholder.

EDITOR

Against a back-drop of a radio relay antenna on the roof of Long Lines headquarters, Mr. and Mrs. Denton hear an explanation of this method of communication from W. H. Schwaikert

If to those sums we add our truly national properties—everything from highways to Navy, from national parks to public buildings and atomic energy projects—we get still more billions, enormous but uncounted. While estimating in these areas is necessarily sketchy, the total wealth of the United States could be placed at as much as 1,000 billion dollars.

The Bell System represents an investment of possibly one percent of the nation's wealth. It employs about one percent of the total labor force. The 1950 telephone bill of Bell System customers represented about one percent of the gross national production of 280 billion dollars.

Capital is commonly expressed in dollars. Let us take a brief glance at the dollars which represent the capital wealth of the United States.

The homes of our 45,000,000 family groups are worth a total of some 250 billion dollars, and other real estate—not including farms—another 50 billions. The nearly 5,500,000 farms are worth—exclusive of dwellings—about 50 billions also, and household goods and automobiles could be assessed at perhaps as much as 100 billions. All these personal assets add up to not far from 450 billion dollars. Now take into account the capital of America's 600,000 corporations and you have an estimated 400 billions more. Those are personal and corporate capital values.

Capital for corporate expansion comes primarily from the net personal savings of its citizens—the money people have left after they have spent what they must or will for what they need and want and after they have paid their taxes.

Since 1929, the annual rate of personal income has increased from 85 billion dollars to 243 billion dollars—a rise of 186 percent. During the same time, the purchasing power per capita of personal income has risen 50 percent. (The difference is due to increased population and the decline in the value of the dollar.) This increase of 50 percent reflects the rise in productivity, which has been made possible largely by technological developments.

During the post-World War II period, personal savings have averaged over 9 billion dollars annually. If only a privileged few had funds left over after providing for the necessities of life and the most wanted luxuries, there could be no millionth stockholder for any corporation.

But year by year in our democracy an increasingly larger percentage of our population is improving its economic status. The rich aren't getting richer while the poor get poorer; the reverse, in fact, is the case, due to the scaling of surtax rates. Despite the pinch of rising prices in recent years, there has been a substantial increase in the number of people owning homes, automobiles, and other durable goods. The astonishing growth in telephones in service is another clear indication of this trend.

Savings ordinarily go into homes, Government bonds, and savings and checking accounts before any part of them is spent for the purchase of stock.

About one-half of all non-farm families and two-thirds of those on farms own their homes. In 1949, the top half of the 52 million "spending units"* in this country averaged about $3,600 in liquid assets such as government bonds and savings and checking accounts. Four out of five of the "units" in this top half had a net worth of $5,000 or more, and one out of five in the group had a net worth in excess of $25,000.

Nobody knows exactly how many stockholders there are in the United States. They have been variously estimated at from eight million to fifteen million. And the above facts indicate that stock ownership is not confined to the wealthy alone. The investment potential in our population reaches out to Main Streets all across the country, and includes people in every walk of life.

In the Looking Glass

THE QUESTION remains as to why more than one million people have invested in the stock of the American Telephone and Telegraph Company.

There are many avenues of ap-

* All persons living in the same dwelling and belonging to the same family who pool their incomes are considered a "spending unit."

At the Murray Hill plant of the Bell Telephone Laboratories, Mr. and Mrs. Denton listen to H. A. Bredehoft's explanation of how telephone bells are tested in the sound-proof room

Genesee Street in Saginaw, Mich., home of the Brady Dentons, might stand for Main Street in almost any one of the 19,000 American communities which are home to A. T. & T. stockholders

proach to this question, and all seem to lead, sooner or later, to the same point: the credit standing of this Company.

Credit is the quality of being believed in or of being worthy of trust. It arises out of good reputation, and out of confidence in the good character that lies behind reputation. In the final analysis, then, the explanation of this million-stockholder phenomenon is in the character of the Company.

The Bell System is a public service, and three means of forming judgment of its character are therefore particularly within the public view.

The first is the usefulness of the telephone itself. The second is the impression gained from both business and social contacts with Bell System people. The third is the dividend record of the American Telephone and Telegraph Company.

Importance of the economic function performed by the Company is fully recognized. The telephone has a significant place in the daily lives of the American people. Each instrument in service is used on the average for about 120 conversations monthly. The quality of our telephone service is of the best. From this viewpoint, the telephone business has received the stamp of public approval.

The personal contacts which the public has with the men and women of the Bell System have established another basis for appraisal of the Company's character. The saying "A man is judged by the company he keeps" could read, for us, "A company is judged by the people it keeps." The contacts with business office representative, installer, and girl at the switchboard penetrate through and beyond such slogans as "The Spirit of Service" and "The Voice with the Smile." The people of the Bell System reflect credit on the industry by being good citizens in their own communities.

Finally, there is the matter of regular dividends. In some speculative business situations, prospects of large future profits in lieu of any immediate return would attract needed capital. Such investors must recognize that they hazard their entire stake. This type of risk-capital fills a vital place in our economy, since no new industry could take root without it.

In the case of an established business, capital can be attracted on a different basis. And if a company's record goes back a long, long way, and shows the payment of 247 consecutive dividends, and if it is well understood that its management is aware of the necessity for maintaining regular dividends at an adequate rate in the future, then the company will look like the American Telephone and Telegraph Company. The group who prefer to risk all for large profit may not be greatly attracted, but the families along Main Street will take note—and there we have one essential basis for recruiting one million stockholders.

But there is one thing more.

Underlying the three aspects of the Company's character which meet the public eye, there has been a fundamental characteristic which can be summed up in the term "vision."

Vision was in evidence in the early decision to lease telephones and provide service instead of selling the instruments outright. It was there when the structure of the Bell System was developed—with regional operating companies to handle local service, another organization to provide long distance interconnections, the Western Electric Company for the manufacture of equipment, and the Bell Telephone Laboratories to insure continuous progress in the art of telephony. Vision was displayed in the development of the internal organization of the operating units with functionalized responsibilities, well conceived lines of authority, and adequate staff departments. It was vision which produced Mr. Gifford's statement of policy at Dallas, Texas, in October 1927, in which he pointed out that the fundamental objective of the Bell System is to provide the most telephone service and the best at the least cost consistent with a fair return to investors and fair treatment of employees. Without vision, the post-World War II financial program of President Leroy A. Wilson could not have been developed. Among the qualities of the Bell System which give it character, vision in management must take first rank.

There are now, in this Seventy-fifth Anniversary Year of the telephone, a million stockholders of A. T. & T. This article has considered the economic soil which has nurtured them. It is still rich, still productive. Will future years duplicate the past—will there be one day a gala welcome for stockholder No. 2,000,000? Who knows? That could happen here. For this is the U. S. A.

Trusteeship in Business

Arthur W. Page

A talk at the Millionth Stockholder ceremony in New York City on May 15, 1951, by a director and former vice president of the A. T. and T. Company

IT OUGHT TO BE a normal thing for every family to own a part of the country in which they live. But in the history of mankind it has not been normal. In this country it is. If you add up those who own houses, farms, or all or part of a business, you will have the greater part of the population.

You may define that as capitalism. I think it is more accurate to say that it is the natural result of freedom, for any man who is free to do so tries to accumulate for himself, his family, and for good causes in which he is interested.

So in this free country we have millions of owners, and as it is an industrial country we have millions of owners of industry.

Great numbers of these owners, like Mr. Denton and the other 999,999 owners of the American Telephone and Telegraph Company, trust other people to run their property.

THE GROWTH of the great corporation owned by hundreds of thousands of people has produced a trusteeship of a size and kind never known in the world before.

The directors who accept responsibility for the operation of the publicly-owned companies not only accept responsibility to their stockholders, but they accept a responsibility to the nation as well, because there are not individuals with money enough to finance business of the size that this great country needs. The many have the money, not the few.

Hundreds of thousands of people can't operate a business. They must trust some few to act for them.

And those who do act in this capacity have a public trust as sacred as that attached to any public office.

Adding the millionth stockholder does not change the responsibilities of trustees, but it does make an appropriate occasion to reaffirm our belief that the trust of millions of people deserves the most meticulous care that men can give it, for this trust is the basis of the tremendous effectiveness of American industry which makes the strength of the country.

And I believe that this trust is justified, for I think its implications become clearer each year and the standards better each year.

EVERY BUSINESS starts with public authority in the form of a charter, franchise, or even a license for a push cart.

The charters are given because the State believes the company will serve the public. There is no other reason for giving it, nor is there any other reason for continuing it. It is a kind of loose contract between the state and the company by which the company earns what it can under competition or regulation and serves the public with goods and services in return.

So the trustees have two duties—to earn money for their stockholders and to serve the public. These two inevitably create a third, for neither the earnings nor the service will increase if the employees of the enterprise are not well equipped, well paid, and well led.

And none of these three can be accomplished by any hit and run method. Big business has to be run with an eye to the long view.

The research in material things and in management practice which makes for better and cheaper products is a long term project.

The building of management that has good men always coming up and opportunities to encourage good men is a long term project.

THE CREATION of confidence in the public is a long term project.

The fact that a corporation does not die at three score years and ten is essential to the success of these great enterprises. The fact that they can enlist and train good officers in endless succession is also essential.

The professional manager, starting at the bottom and rising by merit, is an essential part of present American economy. And he is a trustee as well as the directors. His career is in the successful performance of the corporation's responsibilities and the training of his successors. His rewards—in money, reputation, and satisfaction—are roughly in accordance with that success.

As the managers come up from the bottom, so does the money.

I think there may have been a period before the Federal Reserve Act when money from the general public was scarce and industry had to depend on the limited means of financial groups. That isn't true now. Wall Street may deal in money but it is Main Street money they deal in. Wall Street is a servant of Main Street. Industry gets its capital from Main Street and pays its dividends to Main Street.

MR. DENTON, I can assure you that you are the majority. You have entrusted your savings to American enterprise, which is somewhat different from enterprise anywhere else in the world.

In the first place, the Constitution forbade tariffs between the states and politically made a nationwide market. When transportation was good enough, the nationwide market called for quantity production, and quantity production called for business so big that it had to be financed by the public generally.

And that widespread ownership has necessitated a trust by the investors in the directors and managers of these great enterprises.

THE CHARACTER, experience, and the wisdom with which these trusts are administered will be the test of the success. If they continue to deserve and have public confidence, they will continue to have freedom enough to do their job well. If they fail to deserve and hold the public confidence, they will be hampered by rules and regulations so that they can do less well.

You have placed your savings with us. I want you to know that we understand the kind of a public trust that is, with its countless ramifications, and to assure you that while we shall certainly not always judge correctly, we do sit up nights to seek the straight and narrow path in this confused and complicated world.

We are trustees for your investment in the American System and we shall do our utmost to see that both you and it prosper.

The Telephone Helps Us Out-Produce Any Other Country in the World

Charles E. Wilson

Excerpts from an address at the Millionth Stockholder ceremony in New York on May 15, 1951, by the Director of Defense Mobilization

One of the many things I like about this country of ours is that it can inspire such an occasion as this tonight. I won't say it is exclusively American, but it's likely to happen in very few other countries.

The millionth stockholder comes into the American Telephone and Telegraph Corporate family. A. T. & T. becomes the first private business in the world to be owned by a million people—that is, by a million people and their families.

And what about this millionth stockholder? Is he a fabulously rich industrialist? A banker? A powerful politician? No, Mr. Brady Denton, of Saginaw, Michigan, who with his wife owns seven shares of A. T. & T. stock, is an automobile salesman. He lives in a modest house. He makes a decent but not sumptuous living. He takes part in civic and community affairs. He plays golf and fishes and hunts occasionally. Did he invest for speculation or merely to dabble in the market? Mr. Denton says he bought the stock because he and his wife want their three boys to have a college education. It was a solid investment for the future.

There is something so typically American in this that it seems a footnote to almost any page in our history. It is part of our democracy that an average man like Mr. Denton can have a share in this great corporation. He can rise to his feet, if he likes, at a stockholders meeting and express his own views on the conduct of the company.

In a sense, Mr. Denton is big business. For it is the thousands of Mr. Dentons and their modest investments who go to make up such great corporations as the American Telephone and Telegraph Company. The growth and vigor of this company, as with many others, has been made possible by the savings of the many, rather than by the wealth of a few. Without the investments of thousands of everyday plain folks, it would have been impossible for A. T. & T. to have built and to continue to build the vast network of lines and switchboards and other physical facilities needed to serve the nation.

Such a broad base of ownership is a healthy symptom of a young and growing economy. It shows the faith of the people in our productive future, in the certainty of an ever-rising standard of living, affecting more and more of our people as it continues to ascend.

So this is big business. I have been accused of coming from big business. I have said before: Sure, I come from big business, and I am proud of it. Tonight, as I have the honor to take part in this celebration, I am prouder of it than ever before. If it is an accusation to come from big business, I say: I plead guilty, now impose the sentence. I feel sure that the sentence of the American people would be: We sentence you to as many more years of productive work as you can put in producing things for our betterment at ever higher quality at low prices as you have in the past, providing employment for the thousands of our sons and daughters who are coming along to join America's working force, and building ever more the economic might of the United States.

I HAVE a conviction that most of the people who so virulently attack big business have, themselves, an interest in big business. Either they have shares of stock or they have insurance policies—and insurance companies have heavy investments in the stocks of big businesses. It is almost impossible nowadays for anyone not to have some financial connection, however small, with big business. Yet these persons inveigh against the very institutions that afford them an income or security for the future. It is like the Communists who scream for freedom of speech but use it to overthrow the very democracy that assures that freedom.

It takes big business to make big production. This has been one of the glories of America, and even Stalin at the end of the last war paid tribute to the productive capacity of this country. Perhaps it is the atomic bomb that has deterred him thus far from aggressive moves beyond those he has already engineered. But I think an equal deterrent may well be America's capacity for manufacturing the sinews of war.

IT IS GOOD for our armaments production program that the Bell System has built the biggest and the best telephone system in the world. For in this fast-moving, complex, mechanical age we need quick communications. They are especially valuable in this emergency period of preparation. The telephone breaks down all barriers of time and distance in getting the job done. It has been estimated that in the last war it took 12,000 telephone calls to make a bomber. It probably would take more than that now, because the bombers are bigger, more complex. Think how unwieldy the production job would be without the telephone! I have no doubt that one of the main reasons we can out-produce any other country in the world is because we have the best and most extensive telephone service in the world.

More Than 12,000 Employees, Many of Them Veterans of World War II, Are in All Branches of the Armed Forces In This Country and the Eastern Theatre

Bell System Men and Women On Active Duty

Donald S. Bridgman

Distance, military security, and the time requirements of publishing make this statement about the contributions of individual employees in the service of their country regrettably but unavoidably incomplete. EDITOR

AT THE BEGINNING of last April, nine months after the Communist attack in Korea, 12,330 men and 410 women from the Bell System were in military service.

Almost 60 percent of this total had been called into active duty or had volunteered as members of the Reserves or National Guard; about 25 percent had been summoned through Selective Service; and about 15 percent had enlisted in the Service of their choice.

In the build-up of the Armed Forces as a whole, reserves accounted for about 35 percent of the total additions since last June. The difference between this and the System's 60 percent figure reflects the fact that its employees then included about 25,000 members of such components, or more than 10 percent of the total male force. This was a substantially higher ratio than that for the employed male population as a whole and resulted mainly from the large numbers of World War II veterans returning to or employed by the System Companies, since the great majority of today's reservists served in that conflict.

Of all Bell System employees on military leave last April 1, nearly 6,000 were in the Army, 3,400 in the Navy, 2,100 in the Air Force, and 1,200 in the Marine Corps. The proportion of employees entering the Navy and Marine Corps has been large as compared with their ratios among all post-Korean additions to the Armed Forces. Among women

Col. George L. Walker is commercial manager at Manistee for the Michigan Bell Telephone Company

employees, the Navy is the most popular service, drawing almost 40 percent of the total number.

Little information is as yet available concerning the assignments in which the System's employees generally are serving. Efforts are being made, however, to assist the Services in identifying the communications skills of recruits from the System. This program was first accomplished through Company reports to the office of the Chief Signal Officer of the Army and the communications divisions of the Navy and Air Force about the background of all men with appreciable telephone experience who were entering those services. The practice had been set up with the Signal Corps early in the World War II emergency, and at its request was re-instituted last August and was extended to the Navy and Air Force. Early in 1951, in order to increase its effectiveness, the procedure was modified to provide each man with a copy of the statement of his experience for him to present to the classification officer at the reception center to which he reported.

An activity of a different kind has also been directed toward making the most effective use in our Armed Forces of the special knowledge and skill of System employees. This has been carried on through Reserve units whose officers and enlisted specialists were recruited from participating System companies and who then met regularly for evening drills and in some cases devoted two weeks of summer to active training.

This program was an outgrowth of the affiliated Telegraph Battalions of World War I which had been completely manned by employees of Bell System companies. In World War II, the communications experience and ability of telephone men was made available to a far larger number of units through the use of commissioned and enlisted cadres of such men who were supplemented by others drawn from outside sources for the less specialized positions. About 5,000 System employees provided a nucleus for 380 such units or were assigned to individual staff positions during that war.

The outstanding contribution made by these men—and by those in similar units organized from other communications companies and such other industries as the railroads—led to the establishment of peacetime Reserve affiliated programs in 1947. By June of 1950, eleven units of this type were functioning actively in ten System companies, and in September five of them were called to active duty. The remaining six are still on a Reserve basis, ready to do their part if needed.

Affiliated Units in Service

THE LARGEST of the units called into service was the 303rd Signal Service Battalion, Theatre Headquarters. This was composed of Illinois Bell Telephone Company men under the command of Lt. Colonel A. J. Mitchell, district plant superintendent, State Area. Immediately integrated with it on active duty was the 309th Signal Multi-channel Radio Teletype Detachment of Long Lines employees in New York, led by Captain Ray M. DeShon. Actually it had been a special team in the larger unit's organization but, because of the character of its function and personnel, it had been drawn largely from the Long Lines Overseas Divi-

Co. B., 303d Signal Service Battalion, commanded by Capt. W. G. Miller (left), engineer, State Area engineering organization, Illinois Bell Telephone Company, received a special citation from the Deputy Commander of the Third Army for its "superior condition" sion and had carried on a separate training program. In the combined unit, when called, were 53 telephone men serving as commissioned officers and 40 in non-commissioned and technical specialist grades. When fully organized the unit includes 79 officers and 818 enlisted personnel. In the field, it assists in planning all types of Army communications for a theatre and provides those required at its headquarters.

Maj. W. H. Jamison (right), engineer on special studies, Commercial Department, Southern Bell Telephone and Telegraph Company, accepts for the 94th Bombardment Wing the trophy awarded for top performance in maneuvers last summer

Two other units on active duty are the 313th Signal Operations Battalion, composed of New England Telephone and Telegraph Company men under the command of Lt. Col. M. V. McCormick, supervisor of wages on the general plant personnel supervisor's staff in Boston, and the 66th Signal Operations Battalion, from the New York Telephone Company, with Major G. W. Beyea, division plant supervisor, Bronx-Westchester Area, in command. Included in these units when called were, respectively, 18 officers and 25 enlisted specialists and 18 officers and 15 enlisted men. At full strength, each would consist of 26 officers and 526 enlisted men. The mission of these units is to provide the communications facilities at the headquarters of an Army.

The remaining unit called is the 804th Headquarters and Headquarters Company, Signal Base Depot. Principally composed of employees of the Chesapeake and Potomac Telephone Company in Washington, it was under the command of Col. E. C. Cover, Secretary of the Employees' Benefit Committee of that company. Among the 21 officers and 12 enlisted men enrolled, however, were a number from the Long Lines Department and the Western Electric Company in that area. As primarily a headquarters staff unit, its total strength includes only 24 officers and 91 enlisted men. Its mission is to provide the staff and personnel required for the supervision of a Signal Base Depot group, with both supply and rear echelon maintenance functions.

The 303rd Signal Service Battalion, THQ, the largest of these units, may serve as an example of the seasoned quality of these Bell System cadres. Its commanding officer has had 28 years of telephone

U. S. ARMY PHOTO

Master sergeant John Zimmer (beside truck), a repairman for the New York Telephone Company, supervises erection of a telephone pole in Korea's hilly terrain

service, and the average service of all its officers is nine years. As is natural during a period without general war, the great majority of its enlisted men are young, but the average telephone service of the entire cadre is over six years. More than 80 percent, moreover, had served an average of 3.3 years in World War II. During its training duty at Camp Gordon, Company B of this unit, under Captain W. C. Giller, was commended by the Deputy Commander of the Third Army for its "superior condition;" First Lieutenant J. J. Novacek was cited for "outstanding work" done; and the Information and Education Center developed by the company was called "particularly noteworthy." One of the Battalion's members, moreover, Sgt. G. K. Robitchek, P.B.X. installer, Chicago Plant, was chosen "Soldier of the Month" for March at Camp Gordon, as "the best soldier on the post" in all-around knowledge and performance of military duties.

Bell System Men in Other Reserve Units

In addition to these affiliated units, many others now on active duty include substantial numbers of Bell System men, principally those who had been enrolled in the Reserves. Among these is the Marine Corps First Division, which has made such a gallant record through months of bitter fighting in Korea and which now contains 41 percent Reserves in its enlisted personnel. Sixty-five Reservist employees of the Southern California and Northern California-Nevada Areas of the Pacific Telephone and Telegraph Company were called to duty with this division in July 1950, and 11 additional Southern California men enlisted and were assigned to it. Sixty-one other Southern California employees enrolled in the 40th Division of the California National Guard, went on active duty with it on September 1, and are now in Japan. Four other units, with a total of 123 Pacific Company reservist employees, include two Troop Carrier Wings and two Air National Guard fighter units.

From the Bell Telephone Company of Pennsylvania, 61 men were called to the 28th Division, Pennsylvania National Guard. This division was involved in the tragic train wreck on its way to camp last September in which 33 of its men lost their lives. Fortunately, none of these men were employees of the Pennsylvania Company. Its combat training now completed, it has been commended for fitness by Secretary of the Army Frank Pace and General Mark Clark.

The Southern Bell Telephone and Telegraph Company furnished 36 men and one Waf, and the Long Lines Department and Western Electric Company 17 men from the Atlanta Area, to the 94th Bombardment Wing, called to duty in March of this year, in which most of the telephone employees had been active in its Communications Squadron. This had been trophy winner for top performance in maneuvers the previous summer.

From the Atlanta Area also went 23 other System men in January as part of the 315th Signal Construction Battalion, Lt. Col. J. F. Callahan, a Southern Bell district commercial engineer, commanding.

Twenty-nine Northwestern Bell reservists responded to their summons with the 47th Infantry, Minnesota National Guard; and 15 from that Company's employees in North Dakota were called with the 164th Infantry of that state's Guard.

Except for the largest affiliated battalion, the greatest number of telephone Reservists included in the units noted were the 76 Southwestern Bell men called September 1, 1950, with the 45th Division, Oklahoma National Guard, which early last April was reported to have cleared the Panama Canal en route to the Pacific Theatre of Operations.

In Korea

The only Army reserve unit containing several Bell System men known to be in Korea is the 101st Signal Corps Battalion, called to active duty in August, 1950, with 16 men from the New York Telephone Company. It reached Korea early last April and at latest reports was

U. S. ARMY PHOTO

Sergeant first class Richard Schrader, non-com in charge of the wire head, IX Corps headquarters in Korea, checks newly run circuits. He is a cable splicer for the New York Telephone Company only a few miles behind the front and principally engaged at restoring broken communications lines at night.

Except for this last unit and the First Marine Division, none of the units mentioned had reached the combat area as this was written. Generally, those units have been in the fundamental stages of organization and training. There is not much which is dramatic about that, and the more interesting items may not be reported. Our knowledge of the calibre of the System men in the units, however, and the outstanding record of many of these men and others in World War II, make it certain that this foundation has been laid securely and that they will contribute fully to any demands which may have to be made upon the organizations of which they are a part.

Sgt. Otto H. Maucker, USMC, lineman with the Illinois Bell Telephone Company: Bronze Star medal

For the same reasons, relatively few of the System's men thus far have faced the dust and mud, the burning heat and bitter cold of Korea, or the fanatical attacks of the Communist North Koreans and Chinese. Of some who have, we may not have reports of their experience for months. What can be written now of individual gallantry and sacrifice, therefore, must be fragmentary—but we have learned enough to be proud of those from the System at the front.

The Last Great Sacrifice

TOTAL known deaths of Bell System employees in military service had reached 18 by last April 1. Of these, at least seven had occurred in combat. At least two others are missing.

Five of those killed and one of the missing were members of the heroic First Marine Division. Two of them were in the Pacific Company's large contingent in the Division: Corporal Richard E. De Villiers, draftsman at San Francisco, who died on September 21, 1950, of wounds received in the Inchon landing; and Corporal Galen F. Rohwar, splicer's helper at Van Nuys, California, who was killed near Seoul on September 24. A few days later, in the same area, Sergeant Walter M. Johnson, lineman of the Chesapeake and Potomac Company of Virginia at Roanoke, was killed in action. On November 27, Private Richard W. York, frameman in the Illinois Company at Chicago and the father of sons 2½ and less than 1 year old, was killed near the Changnin reservoir in the desperate fighting at that time. The most recent death reported was that of Sgt. Thomas A. Leaver, switchman of the Southern Bell Company at Nashville. The Marine reservist missing in action since November 28 is Staff Sgt. Melvin J. Gillery, a lineman-installer of the Chesapeake and Potomac Company of Virginia.

From the Army, Pfc. Raymond C. Robson, splicer's helper of the Bell Telephone Company of Pennsylvania at Pittsburgh, was killed in action in Korea on November 4, 1950. First reported as missing in action on February 13th, and later as killed, was 1st Lt. Leonard G. Lyon, cable splicer, of the Second Infantry Division, who left a wife and three young sons. Pfc. Thomas A. Duffey, station installer of the Illinois Bell company at La Grange, a member of 101st Airborne Division, has been missing in action since December 3.

Generally, little is known about the deaths of the men killed in action. Usually they have been serving where casualties were heavy, sometimes where only a few returned, and those have not infrequently been reluctant to speak of their comrades who are gone.

At least some of the circumstances are known in the loss of Navy Ensign Lloyd M. Faver, technical operator in the Overseas Division, Long Lines Department, at Oakland, California, which took place in a combat zone—although not through enemy action. On March 11, he and two other men took supplies, purchased by a collection among his shipmates, in a whaleboat to a colony of orphans on an island off the west coast of Korea. After delivering the supplies to the missionary in charge, they started back to the cruiser St. Paul. They never arrived, and after a two-day search were presumed lost in the heavy seas.

Sgt. William Murphy, USMC, lineman with the Illinois Bell Telephone Company: Bronze Star medal

Fifteen Bell System men have been reported as wounded in action, with Purple Heart decorations in each case. One of these, Pfc. Wallace R. Williams, station installer of the Illinois Bell company at Rock Island, has fought with his Army field artillery unit from near Pusan to north of the 38th Parallel and has participated in three major river crossings. Twice wounded, he has been awarded the Purple Heart and Oak Leaf Cluster.

All of the other men reported have been members of the First Marine Division. In some instances, after being wounded more than once, they spent days without shelter in temperatures far below zero in the long retreat from the Chosin reservoir.

One of these was Pvt. James A. Hawkins, from the Western Electric

Company's Speedway Shops in Indianapolis, who remained in action when first hit by a sub-machine-gun slug but who was wounded three more times before removal from the Red encirclement by helicopter. Besides the Purple Heart, he wears four battle stars, and ribbons for an Army Citation and for a Presidential Citation of his regiment. Another was Pfc. Walter Degler, apparatusman, of the Ohio Bell company in Cleveland, who, resenting his IV-F classification of World War II, enlisted in a Marine Reserve unit and has survived severe frost-bite, concussion, and shrapnel wounds in both legs. A third, Pfc. George H. Culverwell, reproduction operator for the Pacific Company at San Francisco, was with a company in which all but 37 of its 250 men were killed. Other Pacific Company members of the Division report thirteen days and nights of continuous hard fighting without rest at temperatures of 20 to 26 degrees below zero.

One of the men wounded at that time, Marine Sgt. Otto H. Maucker, lineman of the Illinois Bell company from Rock Island, has been awarded the Bronze Star Medal for an earlier action, which occurred on September 26. His citation reads in part as follows:

> During an attack by his Company on strong enemy positions, Sergeant Maucker, acting as a platoon guide, observed a wounded marine lying in an open fire-swept area. Without regard for his own personal safety, he fearlessly exposed himself to the enemy small-arms and machine-gun fire to run to the side of the wounded marine, and by carrying him on his back approximately three hundred yards enabled the wounded man to receive medical attention and be evacuated.

Lt. Col. James W. Dodson (right), USMC, assistant secretary of the Employees' Benefit Committee, Southwestern Bell Telephone Company, receives the award of the Legion of Honor

The Bronze Star, with Presidential citation, was awarded to a second Illinois Bell man, Sgt. William Murphy, lineman at Evanston, for heroic action in operations against the enemy. According to the citation:

> acting as a wire chief with a platoon of 81 mm. mortars, Cpl. Murphy continually performed his du-

ties in an outstanding manner. On two occasions, he volunteered to lead a detail to carry ammunition forward and evacuate casualties from a hill on which a rifle company of his battalion was being pressed by enemy forces. Cpl. Murphy, with complete disregard for his own personal safety, continuously exposed himself to heavy enemy small-arms fire while directing his men along the most expedient route of approach. His skill and courage in leading his group to the company positions enabled the company to effectively maintain its position and evacuate its wounded.

For heroism in risking his life to save a fellow soldier during training in Louisiana, Sgt. 1st Cl. J. T. Jones, installer, of the Southwestern Bell at Stillwater, Oklahoma, and now serving in Korea, has been awarded the Soldiers Medal. The text of his citation is not available; but it is known that Sgt. Jones pushed a live hand grenade, badly thrown by a recruit, from the top of a sandbag shelter where it had landed, and, as the recruit ran from the grenade, pulled him down with a flying tackle and lay on top of him to protect him from the blast.

For exceptional services of a different but no less essential type, Major (now Lt. Colonel) James W. Dodson, assistant secretary of the Employees' Benefit Committee, Southwestern Bell Telephone Company at Dallas, Texas, has been awarded the Legion of Merit with the following citation:

For exceptionaly meritorious conduct in the performance of outstanding services to the Government of the United States as Intelligence Officer of a Marine Aircraft Group from 30 August 1950 to 10 December 1950. Assuming control of that staff section, Major Dodson devoted long and trying hours to the procurement and preparation of necessary maps, information and equipment for the operation of his staff. Asserting his personable manner and mature judgment, Major Dodson, with painstaking effort, meticulous attention to detail and outstanding determination, organized and trained his staff section into a smoothly functioning team prepared for any combat situation. During the operation of the group from Kimpo Airfield, Korea, and later from the Yonpo Airstrip in Korea, Major Dodson was directly instrumental in the prompt collection, evaluation and dissemination of vital information concerning the enemy. His manner of presenting information of enemy installations was such as to inspire the pilots with the fullest confidence in their ability to destroy them. His untiring efforts, enthusiasm, and skillful service throughout was in keeping with the highest traditions of the United States Naval Service.

Letters from some of our associates in the service testify that the chance to come back to an organization like the System is a fortification in days of hardship or suffering. Every member of the Bell System family still safe at home hails the devotion and gallantry of these men, who have stood fast in the first line of defense against aggression and for the survival of the free nations and all they represent.

Bust of Dr. Bell in the Hall of Fame

Busts of Alexander Graham Bell, inventor of the telephone, and Dr. William Crawford Gorgas, who rid the Panama Canal Zone of yellow fever, were added to the Hall of Fame for Great Americans at a dedication ceremony held in the auditorium of the library of New York University in New York City on May 24.

The bronze likeness of Bell, sculptured by Stanley Martineau, was unveiled by the inventor's daughter, Mrs. Gilbert Grosvenor, assisted by Marian Hubbard Bates, a great-granddaughter of Dr. Bell. Mrs. Grosvenor spoke briefly, giving some interesting personal reminiscences of her father. Several other descendants of Dr. Bell were present at the ceremonies.

Dr. Charles F. Kettering, research consultant to General Motors, in paying his respects to the memory of the telephone's inventor, said that in these tense days we must remember our great Americans as being the main elements of our nation's continuation and strength.

Dr. Oliver E. Buckley, chairman of the board of Bell Telephone Laboratories, presented the bust of Dr. Bell to the Hall of Fame on behalf of the A. T. & T. Company and the Bell System.

Paying respect to Bell as an inventor and scientist, Dr. Buckley characterized him as a man of great vision, with strong feeling for others. It was this zeal in helping people to communicate their thoughts and feelings that gave Bell the inspiration that led to the invention of the telephone, Dr. Buckley declared.

As Mrs. Gilbert Grosvenor, daughter of Alexander Graham Bell, unveils a bronze bust of the inventor, a wreath is placed before it by Marian Hubbard Bates, a great-granddaughter, while Dr. Ralph W. Sockman, director of the Hall of Fame, looks on

Dr. Ralph W. Sockman, director of the Hall of Fame, presided over the ceremonies, which were witnessed by an audience of 1200 people. Dr. Sockman read a message from Helen Keller, who is now traveling in South Africa but who wished to pay her respects to the memory of Dr. Bell. Music at the impressive ceremony was provided by Lucile Cummings, Telephone Hour artist, and the New York University Chapel Choir.

Management Jobs for Women Have Helped Improve Service In Important Phases of Commercial Operations and Have Afforded New Opportunity to Show Their Capabilities

Women in Business Office Supervision

Emma W. Condit

THIS IS a report upon the most recent change in the business office organization: i.e., the addition of women business office supervisors, and what this has meant in the way of improvements in business office operations and service.

First, however, let's take a look at what the creation of this management job for business office women has meant to the women themselves.

It has opened up new and broader horizons for them and has helped satisfy their urge to advance and take their place beside men in the active management of the telephone business.

It has given business office women their first big opportunity to exercise fully their knowledge of the business and their initiative, resourcefulness, and imagination—a chance to "show what they could do."

It has gained further recognition of the fact that as the opportunities arise, women are considered along with men for positions of greater responsibility. Already many women have met the challenge of competition and have progressed to higher supervisory and staff jobs.

WAR-TIME NEEDS seem to bring basic changes in business office operations. As far back as World War I, when more and more men left to join the Armed Forces, women were used for the first time to handle telephone and office contacts with customers, a job it had been felt until then that men should handle. Their success led to the use of women in the service representative plan of business office organization.

Absence of men in World War II gave service representatives a real opportunity to show their supervisory ability, thus starting a new level of organization, the Business Office Supervisor. The job owed its origin to the fact that at the time that losses to the armed forces in World Wor II were sharply curtailing the number of men available for business office supervisory jobs, the need for supervisory assistance was actually rising rapidly.

This was due to two conditions. First, higher force turnover, stimulated by the impact of war, made it necessary to operate business offices with many inexperienced representatives, who naturally needed much help. Second, the need for help was accentuated by a large increase in hard-to-handle contacts with customers, which were, in turn, due to war-caused shortages of telephone facilities which made it impossible to give many customers service without considerable delay.*

It had been the general practice to organize business offices into units of about ten service representatives, each under the direction of a manager, who had the part-time training help of a coach. The increasing need for more supervisory help was met by enlarging these units to two or three times their former size and furnishing managers with the assistance of women supervisors. These supervisors were given supervisory responsibility for a group of service representatives and much of the authority delegated to managers on matters beyond the representatives' jurisdiction. These latter items included such matters as extending credit or making adjustments over a given amount of money, or approval of special cases of emergency action. The manager's job became somewhat more administrative in character.

* See "We Don't Like to Say No," MAGAZINE, Summer 1944.

It should be a source of pride to women in the entire organization, as well as those in the business offices, that the supervisor plan proved most helpful in maintaining good business office service in the face of very serious wartime difficulties. So successful was the plan that, instead of serving only as a war-time expedient, it became the peace-time standard.

The plan soon met another serious test in the post-war period of high force turnover, soaring demand for telephone service, and held order peaks. Again the plan proved successful, and helped materially in insuring that everything practicable was done on business office contacts to maintain public understanding of the facilities situation and confidence in the Companies' handling of it.

The plan is now so well established that there are over 2,000 business office supervisors in the Bell System.

THE BEST WAY to report upon experience with the supervisor plan may be to explain what these supervisors do and how their job appeals to them. The job has real appeal for many reasons.†

There is the importance of the work supervised. For example, the supervisor is directly responsible for the work of a group of service representatives who are in charge of the service and collection records of nearly 15,000 customers. These representatives handle inquiries from their customers about all kinds of telephone business matters, as well as attending to the collection of their accounts, which usually amount to a

† See "Business Office—Miss Smith Speaking," MAGAZINE, Autumn 1950.

Throughout the day, the business office supervisor keeps closely in touch with the amount and kind of work on hand and the progress being made

total of around $1,500,000 a year for the supervisor's group.

Much of the appeal comes from the supervisor's association with her service representatives—who are an articulate and very intelligent group.

It comes also from the concept of the place of the business office in the telephone company's scheme of things and the standards set for it as regards philosophy of service and customer relations.

The scope of the supervisor's job is most interesting. She has to see that the high standards of business office service are met and that the work is produced efficiently and economically. To accomplish this, she furnishes the kind of leadership which will inspire her people with the "will to do" and "pride in accomplishment"; she analyzes the quality of service they render the public and takes any action needed to help them to improve or maintain it.

The supervisor trains and develops her representatives, and is available at all times to assist them with answers to difficult and unusual questions or with interpretations of Company policies and practices. She makes the necessary adjustments in the work or force in order to make the best use of her people, keeping them productive but not so busy that the quality of their work suffers, and she handles those cases which involve business decisions beyond the representatives' experience or where the customer for one reason or another wishes to speak directly to a management person.

The job's greatest appeal lies in the feeling of helping—of helping customers, and also of helping representatives to develop as quickly as possible to the full extent of their inherent ability and to form an interested, congenial, and coöperative group.

Place of Business Office in Telephone Company Operations

THE SUPERVISOR feels she has a key job in insuring that the business office plays effectively its part in telephone company operations. In all she does, she must be guided by the concept of what the business office has been set up to accomplish, and she must do her best to help make this concept a reality.

This concept is based upon the fact that the business office has been established as the place for customers to call upon if they want to obtain information or action on any telephone company matter or help in any service difficulty not taken care of to their satisfaction. These requests may cover a wide range of subjects and relate to almost every aspect of telephone company operations.

Although operated by the Commercial Department, the business office is not just a commercial office. It is the *Company's* business office, representing all departments and the management—acting as their spokesman in dealing with customers and as the customers' spokesman in dealing with the Company. If it were not so, customers would have difficulty in trying to find out what department handled the subject of their inquiry and how to get in touch with it. Consider for a moment the complications and inconvenience when the nature of the customer's inquiry involves more than one department. Indeed, each department or subdepartment would otherwise have to set up its own little business office to handle customer inquiries.

This concept extends to collections, for which the business office is responsible. The number of customers and the sum total of their bills, even if individually not large, make collections a volume job. It must be done economically and expeditiously. Good service and good customer relations, however, require personalized and individual consideration to each customer's account. The habit of prompt payment must be promoted, of course, but this must be done tactfully. Thoughtfulness must be combined with good business judgment in handling the many delicate questions arising in connection with collections in the telephone business—as in any other business.

A philosophy of service has been carefully developed for guidance in the management of business offices and to serve as a motivating spirit. To be effective, it must evoke sincere belief and faith. Every contact should be regarded as an opportunity to build up public good will for and confidence in the Company—a matter which becomes of even greater importance as the contacts of Company employees with customers decrease because more and more calls are dialed.

This service philosophy recognizes that, in contacts with the business office, customers are entitled to promptness and accuracy of information given or action taken. More is felt necessary, however. Contacts must also be of high quality with respect to what is termed "Overtones" —i.e., making the customer feel the Company is a friendly organization, easy to deal with and truly interested in him as an individual. This means customer contacts must be handled not only courteously but in a manner which is sympathetic and which conveys personal interest in the customer's case and a sincere desire to be as helpful as possible under the circumstances. If for some reason it is not possible to comply with the customer's request, he should be left with a satisfactory understanding of why, and what alternative action—if any—can be taken.

Translation of this service philosophy into reality takes more than good intentions. It requires planning, training, and emphasis on its day-to-day application. It calls for a high degree of leadership on the part of the supervisors to help representatives to want to achieve this objective—*and to achieve it.*

Training and Development of Service Representatives

To FACILITATE meeting business office objectives, and also assure economy in operations, the best experi-

The supervisor is readily available to help service representatives with matters they have not yet been fully trained to handle ence in operating business offices has been crystallized into systematic operating procedures. It is the supervisor's job to make sure that these procedures are followed in day-to-day operation—but followed intelligently.

Company instructions must be followed literally when dealing with certain matters, such as charges for service or conditions under which service is furnished, as covered in tariffs filed with regulatory bodies. This applies also to interdepartmental practices, such as those governing the form and detail in which information is furnished to other departments to enable them to do whatever is necessary to complete customers' orders for service.

It does not mean that the job becomes routine or mechanical. Far from it. Most routines serve as a guide rather than as ironclad instructions, because in dealing with customers so many different situations arise when the exercise of good business judgment and the philosophy of service affect the decision as to what to do. Furthermore, no one book of rules could be written that would foresee all the situations that will arise and, by prescribing in advance the best decision, eliminate the need for good judgment.

In both the formal training of her people and in helping them in day-to-day operations, the supervisor must, therefore, make certain that they are well acquainted with the

The supervisor accomplishes much of the training and development of her representatives through day-to-day discussions of the work as it is being performed

Company's procedures and practices and use them intelligently. This requires building up their understanding of the reasons underlying the subjects covered and developing judgment in making sensible decisions. In this, the approach of considering what they would do if they "were in their own business" is an important feature.

BEFORE being assigned to a supervisor's group, a new representative takes an initial training course of about six weeks' duration. However, so wide is the range of knowledge and judgment required that it is not practicable to cover more than would enable her to handle some eighty percent or so of the subjects and situations she will be called upon to handle. The further training of the representative is the supervisor's responsibility, although in times of substantial turnover or inexperience in the force she may need help in order to insure that this important phase of the representatives' development continues without interruption.

In this continuation training, representatives are taught the subjects not covered during the initial training course and are also developed with respect to load carrying ability, good working habits, and judgment. Most of this training is given on a formal basis off the job, usually at the rate of three or four hours a week for some six to eight months. Much of it, however, is done informally on a day-to-day basis on the job—as a natural part of discussion of work with the representative at her desk or in answering her questions.

New representatives are taught not to try to handle matters in which they have not been trained but, rather, to ask what should be done. It is not good service to take a chance, and every customer is entitled to have his case handled correctly. Being ready at hand to help employees by answering questions is a very important part of the supervisor's job, and may become quite time-consuming if the number of inexperienced employees increases. The supervisor is, of course, careful when answering questions to give the full background information and "reasons why" so essential to intelligent handling. If the complexity of the matter calls for more comprehensive discussion than time permits, she makes arrangements for some one else to take over the contact.

As a representative becomes more experienced, the questions she raises should become correspondingly fewer if the supervisor has been alert to strike a proper balance between helping her and developing her self-reliance. The supervisor's best approach to her job is on the basis of helping representatives to help themselves wherever it is practicable.

SELF-RELIANCE and confidence are promoted partly through building up a firm foundation of knowledge of the job, good working habits, and good business judgment. In addition, however, the habit of self-analysis on the part of the representative must be encouraged in order to start a process of self-development and feeling of responsibility which, coupled with the supervisor's help and advice, will result in faster improvement in all aspects of her work.

This approach makes the job more interesting and satisfying for both the representative and the supervisor. Their work then becomes a joint endeavor directed towards giving each customer the very best service.

Of great value in training are the quick morning meetings or lengthier "experience" meetings when the group as a whole assembles to talk over problems and matters of interest to all. This provides an excellent opportunity for all members of the group to express their ideas and make suggestions so that each may benefit by the combined experience of all the individuals. This sense of being an actual player on a team helps to create the atmosphere of coöperation so important to a good job.

The Supervisor's Management Procedure

Both with respect to the performance of individual representatives and for her group as a whole, the supervisor's success is largely governed by her acceptance of responsibility for results. This requires her to be an alert, analytical, and practical thinker in order to ascertain opportunities for improvement, to determine the underlying causes affecting performance, and to decide upon suitable corrective action. In addition, she must be a leader and a doer to make sure the required action is carried out and to follow it up until the desired improvement is obtained.

Experience has permitted the formulation of a very helpful management procedure for supervisors' use. Part of this management procedure provides the supervisor with a way of working which facilitates fact-finding with respect to performance and in keeping in constant touch with the flow of work through the office. Just as no two days in the office are exactly alike in the volume and nature of representative's work, neither are any two representatives exactly alike in experience, ability, attitude, and responses.

The management procedure recognizes, therefore, the need for the supervisor to vary her day-to-day activities to meet the changing needs of her people and job. Since in her group there are representatives in various stages of development, each must be given "tailor made" help and assistance. Because there are so many matters to which the supervisor must give attention, to be effective she must plan the use of her own time carefully. Only in this way can she insure keeping closely in touch with her people, knowing what help they need, and being effective in showing them how to do the best possible job. Only in this way can she make sure that a consistently high quality of work is done.

Most of the supervisor's time each day is spent circulating in her group. She keeps in constant touch with the work passing through the office, taking such steps as are necessary to determine whether customer contacts are being handled accurately, properly and with good overtones; whether good business and customer relations judgment is being exercised, as in the case of deciding upon action to be taken in collecting outstanding

The supervisor holds frequent group meetings, in order to keep her representatives posted on matters of general interest and give them opportunity to exchange ideas and experiences

bills; whether the work is being well organized to ensure the maximum of efficiency and speed and in doing first things first.

When she has a first-hand picture of the strengths and weaknesses of each representative, the supervisor can undertake careful study to decide the probable causes for any situations needing improvement and the appropriate corrective action. Since there are usually many possible causes which affect performance, the supervisor must be sure to locate the true one in each case in order to give constructive help. She must consider, for example, whether the representative's difficulty is due to lack of knowledge, not understanding objectives, inefficient work organization, trying to carry too much work, carelessness, or some personal trouble.

This method of operating—constantly circulating through her group rather than spending her time at her desk—has many advantages beside providing the supervisor with a fund of information regarding what she can do to help representatives improve their work and an opportunity to give such help on the spot whenever appropriate. It helps her to make sure she is on hand to answer those questions which we have seen it is so important to answer for new representatives.

Questions are also raised, of

course, by other representatives who wish to draw upon her broad background and experience for assistance in making decisions on matters of judgment. Here, however, as in the case of newer representatives, the best technique to follow is that of furnishing any background the representative does not have and then proceeding to build up reasoning ability and self-reliance by asking the representative what she thinks should be done—instead of merely supplying her with an answer.

THIS METHOD of working in her group also facilitates promptness in the handling of any special matters in need of her attention or approval —an important part of the supervisor's job which can become quite time consuming. Some of these may be cases where the customer does not seem satisfied, despite the best efforts of the representative. Others may be cases where the decision to be made exceeds the authority of the representative. The amount of time spent in dealing with such matters varies, of course, with conditions under which the telephone company is operating. Facility shortages can substantially increase cases which must be referred to supervisors.

"On the floor" supervision also helps the supervisor to keep in close touch with the amount of work on hand in the group, the progress being made in clearing it, and the need for any changes to handle it expeditiously. The volume of work anticipated for each day in the month can be forecast with reasonable accuracy and the manager and the supervisor together plan in advance the number of people needed to take care of it. There are, however, unexpected lulls and peaks from time to time which require shifts in plan. This calls for alertness, skill, and ingenuity on the part of the supervisor. When the volume of work is greater than anticipated, she must make a decision as to what the best course of action is: for instance, to postpone non-demand work until a less busy time, to try to borrow help from another group, to cancel off-the-job training or, as a last resort, to arrange for the force to work overtime. When the volume of work is less than anticipated, she must again make adjustments to be sure each employee is occupied productively—such as taking advantage of the opportunity to do needed training or completing work held over from a busy period.

The Supervisor as a Leader

BECAUSE the supervisor's job is to get results through people, she recognizes that her leadership must inspire representatives with the "will to do" and "pride in accomplishment." She seeks to have her group maintain high standards of business office service, perform their tasks economically and well, and work together happily as a team. To accomplish this, she promotes a thorough understanding of and a belief in the Company's objectives and a sound pride in the Company as a place to work. Pleasant surroundings and congenial fellow workers make their contribution to the *esprit de corps* of the group.

An important factor in each new representative's understanding is the Company's "induction program," which helps to inform her about the

The supervisor continues classroom training of new representatives, at the rate of three or four hours a week, for six to eight months after they have taken over their assignments in the business office

Company—its aims and organization and operations—and the opportunities which it offers her.

In dealing with her people, the supervisor can do much by effort and by example to create a happy office and a genuine enthusiasm for the work. She can be very helpful, for example, in encouraging representatives to keep constantly in mind the broad benefits to the business that come from living up to the Company's basic policy of service—even when an occasional contact with a customer may be extremely difficult or require great patience.

Or, for another instance, consider handling customers' complaints of party-line interference in localities where shortages of facilities may make it impracticable to furnish a better class of service for some time yet to come. The supervisor who succeeds in maintaining the cheerfulness and enthusiasm of her representatives in meeting such difficulties contributes effectively to the customers' understanding of the situation and their coöperation in the use of party lines until the situation can be relieved.

To be effective in customer contacts, overtones of service must become an integral part of the character and spirit of the business office group. This is another reason why the supervisor must inspire a high level of morale and coöperation and a sincere belief in the service philosophy.

The supervisor's effectiveness as a leader depends to some extent upon her authority. For example, she assigns and directs the work of employees. She gives approvals. Her judgment of the satisfactoriness of people plays a most important part in their selection, promotion, transfer —or what happens to them if they aren't satisfactory. Often more decisive is the authority she develops through the leadership she exercises and the manner in which she helps and supervises her representative. She must, in addition, show interest in employees as individuals and in their personal problems and activities —including their social affairs.

Fairness, courtesy, and tactfulness are essential. A feeling of participation must be developed through consultation and interest in their ideas and suggestions. Employees must be made to feel that they are kept informed both about their own progress and about things happening in the business that affect them. Results in the office are discussed with them and their suggestions are welcome. As ever, recognition of good work is stimulating.

Selection and Training of Supervisors

Great care and much consultation surrounds the selection of candidates for supervisory jobs. As leaders of service representatives and responsible for their training, development, and results, supervisors must be chosen from the top-flight representatives who are well grounded in all aspects of business office work.

More is necessary, for certain qualifications are essential which are not present in many excellent representatives. For example, consideration must be given to the ability of the candidate to teach others—to impart new knowledge so that it will be remembered and to promote understanding, good judgment, and reasoning ability. There is the paramount question of leadership capacity: acceptance of responsibility for results, and ability to get the job done and well done on time by others.

Before a new supervisor is put in charge of a group of representatives, she is given an initial training course of some three weeks which combines classroom training with on-the-job application of what is covered. This training includes leadership, techniques in developing her people, day-to-day management procedures, and interpretation of service results information and the service philosophy of its application.

As in the case of the service representative, the supervisor's training does not end with the initial training course. After assignment, it is the continuing responsibility of the manager to help her improve her skill and also to develop her to the full extent of her inherent ability, having in mind ultimate possibilities of future advancement.

While it is difficult to speculate upon what the future may hold, women in the business office feel that, as they continue to demonstrate their capacity to accept and meet responsibilities, opportunities for further advancement will also continue.

Gamblers and Telephones

Editor's note:— The Annual Meeting of the American Telephone and Telegraph Company on April 18, 1951, took place shortly after the conclusion of public hearings by the Kefauver Committee to Investigate Organized Crime. The following statement was made in response to a stockholder's question regarding the use of telephones by gamblers:

"I would like to say flatly that the telephone companies of the Bell System do not want 'bookie' business. They want no part of it. We coöperate in every way we can with law enforcement agencies to keep such business off of the lines and the facilities of the Bell System. We do that short of listening in, of tapping in on conversations, and short of taking over the function of law enforcement itself.

"What we do when we get an application for service is investigate, and if we have reasonable cause to believe that that service will be used for gambling, we refuse to put in the service. If, after the service is installed, we are advised by a law-enforcing agency that that service is being used for an illegal purpose and it has evidence to that effect, we discontinue the service immediately. We do not countenance in any way the use of our facilities for gambling or for illegal purposes. We try to get rid of it in every way that we can.

"Now, to talk to this point that there are twenty or thirty telephones in one location that we must know about:—I think the inference is that when those cases are discovered, the telephone company knew about them all the time and condoned those instruments being in there; and to make that inference is not to understand how these telephones get in there in the first place.

"Let me explain what our practice is. We don't put twenty telephones into any one location without a thorough supervisory investigation. It comes all the way up the line from the people down the line to top supervisory people. We make that investigation in each case where there are more than two telephones going into a location. As I say, where we have any cause to believe that it is to be used for gambling, we do not put in the service.

"Where there is a doubt as to whether or not it is going to be used for gambling, and we cannot get additional data to sustain that doubt, we notify the law-enforcing agencies of that application. We disconnect any service where we find wires or the instruments have been tampered with. We disconnect any service where we cannot get access to the premises for any reason.

"What these gamblers do, as a general rule, on these batteries of twenty or thirty telephones, is that they will go into a neighborhood, they will buy up, so to speak, the use of certain subscribers' telephones in that area. That in itself is an illegal practice, but that is what they do. They buy up the use of those telephones. They run them in with their own help to a central location. They will operate there for a short period and then move on to some other location.

"I just want to repeat that we want no part of it. We know that you want no part of it. We want to get rid of it. We try every way that we know how to get rid of it."

Opportunity, Training, and Inclination Make Bell System Employees Assets to the Communities Throughout The Nation In Which They Work and Dwell

Telephone People Are Good Neighbors

Stuart R. Trottmann, Jr.

"OPERATOR, get a doctor—quick! My wife is terribly sick!"

Verna Clanny, the operator, and Gertrude Morris, a service assistant, both of the Malden, Mass., central office, began making calls at once. They worked swiftly, trying to locate a doctor. Some were not at home, others were holding office hours. Finally they found one who was ready and willing to go to the aid of Mr. Angelo Chester, the subscriber who had called so frantically for help.

The doctor asked to speak to Mr. Chester first. He was connected at once, only to hear Chester say, "Come quickly! I'm passing out just as my wife did!"—and his voice faded out. The doctor told the operators he was leaving on the run.

Miss Morris then called the police. They arrived at the Chester home in four minutes flat. They found the young couple unconscious, overcome by a lack of oxygen. (It was later learned that, in an attempt to warm their apartment, the couple had lighted the gas burners while all the windows were shut.)

Meanwhile, back at the central office, the two women waited anxiously to learn whether the doctor and the police had been successful in saving the Chesters. They were notified soon that the young people had been revived. Next day, the newspapers cited the two telephone girls for their prompt action, and credited them with saving two people in a narrow escape from death.

This experience was a "first" for Verna Clanny. She had only recently completed her basic training and was relatively new to her switchboard position. Not so in the case of Gertrude Morris. In her 28 years as an operator, she had more than once been instrumental in the saving of a life.

Indeed, incidents such as the one related above are virtually "old hat" to many of the more than 235,000 Bell System girls who man our switchboards from coast to coast. The Chester incident approaches the typical rather than the unusual. To Misses Morris and Clanny, it was all in a day's work. But to the Chesters it was service beyond price.

Urgent calls—made thousands of times each day—are handled with speed and calm competence. As a result, the telephone-using public has come to look to the telephone first in time of need.

Operators accept this trust and carry it well, as do all telephone people. Their training and the tradition of their business have accustomed them to emergency. Their reaction to it has become almost instinctive. Call it spirit of service, *esprit de corps*, or what you will—telephone people have it, and you can read about it 'most any day of the year in the daily press. It is this spirit of service, this willingness and desire to help, that makes them good neighbors, good people to have in the community.

Millions of Personal Contacts

TELEPHONE PEOPLE have no corner on the good neighbor market. The basic difference between our people and the men and women of most

Vail Medals and Citations are awarded for acts of noteworthy public service. Here Keith Hough, William Edmunds, and William Payne, of Cheyenne, Wyo., who saved several lives with a company "snow buggy" during a raging blizzard, are receiving their silver Vail Medal Citations from President Floyd P. Ogden of the Mountain States Telephone and Telegraph Company other businesses lies in their opportunity to be good neighbors.

Operators, service representatives, tellers, repair clerks—all "inside" workers who deal with customers—have myriad opportunities to be neighborly in an on-the-job fashion.

Installers, repairmen, linemen—the telephone men who enter your home and work on your streets—have an even greater chance to enact the rôle of good neighbor. Their opportunity may occur in connection with the job; again, it may have no connection whatsoever, arising simply out of the fact that the telephone man happened to be in the right place at the right time.

The number of personal contacts the men and women in the telephone business have with the public in the course of a year is astounding. Consider, please, a few statistics. In 1950, installers and repairmen entered homes and places of business about thirty million times to put in or change or repair telephone service. There were ninety million personal contacts between customers and employees at our business offices. Operators put through more than two billion long distance calls. And the American people, the most prolific users of the telephone in the world, talked 52 billion times over the telephone in 365 days.

Our business, by virtue of this huge number of personal dealings with its customers, enjoys a unique position in American life. Because of that unusual characteristic, we are enabled to be a human as well as a big business.

In effect, the telephone company is known by the people it keeps. And the people it keeps are good people. They act as good neighbors in many ways; their standard of service on the job is their standard of conduct—of living—off the job.

Acts of Heroism

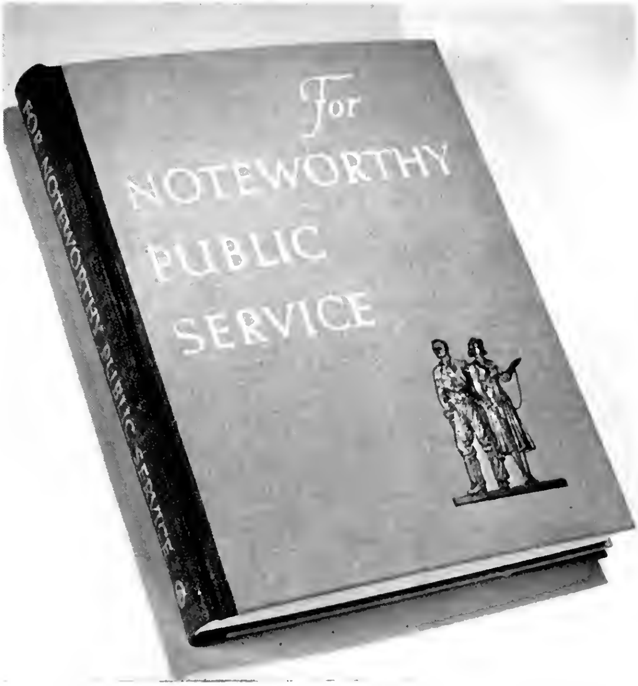
The act of heroism is a relatively rare specimen. People don't often perform acts that fall under the heading of heroic—they simply don't get the chance. It is an infrequent occurrence when someone is called upon to risk his life to save another.

Yet such dramatic events most certainly do happen. That they happen to telephone people is a matter of record. Vail awards (which include a medal and a sum of cash) are made from a fund established in 1920 as a memorial to Theodore N. Vail, former A. T. & T. president, to perpetuate the System's ideals of public service. And in the 31 years since the inception of this practice, 1420 awards have been given to telephone men and women for unusual acts and service in emergencies.

Not all "good neighbor" acts of heroic proportions receive Vail awards, of course, but many are candidates and some are selected. In 1950, for example, four people were awarded silver Vail medals and $500 in cash each for "courage and devotion to duty." Three were Plant Department men who braved a blizzard to rescue people stranded and in distress; the fourth was an operator (employed by a non-Bell company, incidentally *) who remained at her post during a disastrous fire to send aid to her townspeople.

The three men, William Edmunds,

* United Telephone Company.



This volume describes the outstanding acts of loyalty, devotion to duty, and courage performed by the telephone men and women who have been honored with gold and silver Vail Medals

Keith Hough, and William Payne, all of Cheyenne, Wyoming, manned a snow buggy † for three days under the toughest of conditions to rescue people caught in the howling storm. At great personal risk, they battled mountainous drifts, bitter cold, and winds of gale velocity. As cases were reported to them by the Highway Patrol and the American Red Cross, they set out in the versatile little snow buggy. They saved persons imprisoned in cars and brought food and fuel to others in isolated homes. Among those rescued by this trio of intrepid young men were three expectant mothers and three persons seriously sick or injured.

The operator honored with a Vail Award was Mrs. Helen Doris Turner, of Hyndman, Pa. This gallant woman remained at her switchboard, despite fire-fighters' warnings of danger, during a raging fire that gutted the heart of the small town. Using a flashlight and the glow of nearby flames to light her board, she summoned fire departments, ambulances, the Red Cross, and doctors. In all, she stayed on duty for 22 hours.

Another heroic deed—dramatic in every respect—was performed one cold February afternoon by telephone lineman Robert Foley, of Dorchester, Mass. Foley rescued young Donald King, who had fallen through the ice covering a creek. Foley submerged himself under the ice three times before locating the drowning boy. Quick artificial respiration by Foley's foreman, John Fitzgerald, had young King breathing by the time the police and firemen arrived with an inhalator.

For his courage and resourcefulness, Robert Foley received a Vail Medal and a medal from the Carnegie Hero Fund Commission. There is an epilogue to the Foley story: a veteran of World War II, he is now back in the United States Navy, serving in the amphibious corps.

† A telephone repair vehicle equipped with skis and tractor treads enabling it to travel over deep snow.

These telephone men are typical of the many who find Boy Scout work an interesting and worth-while endeavor

Uncommon, the heroic deed, yet each one adds another chapter to the already brilliant record compiled over the years—a record of which telephone people everywhere can well be proud.

Service to the Community

TELEPHONE PEOPLE are naturally inclined to take an active part in the affairs of the community in which they live. Thus, you'll find them devoting time and energy to such diverse pursuits as Red Cross work, Community Chest and other worthy campaign drives, Boy Scout and Girl Scout troops, service clubs, charity work, and many other comparable endeavors. The list is impressively long—there is virtually no type of civic activity to which telephone people do not lend themselves in some capacity or other.

A typical example of a good neighbor in a small community is Mrs. Winnie Knox, who hails from a county-seat town with an intriguing name—Medicine Lodge, Kansas. Mrs. Knox is chief operator for the Southwestern Bell Telephone Company there. She is, in addition, an extremely busy woman. To list her activities: county chairman of the UNESCO, health and publicity chairman of the local Business and Professional Women's Club, state district director of the same organization, vice president of the Chamber of Commerce, vice chairman of the Blue Cross and Blue Shield in her county, and commander of the County Cancer Society.

A real asset to her community, thought the editor of the Medicine Lodge newspaper. He put his thought into words and printed an editorial about Winnie Knox. He described her as the "one particular person who has given most unselfishly of her time and effort in almost every major project that has come along—all out of a sincere interest in the community. . . ."

Another good illustration is the work of Charles N. Smith, manager for the New York Telephone Company at Newburgh, New York. His participation in the civic affairs of his city is extensive. Mr. Smith is a member of the Rotary Club, the Beacon Chamber of Commerce, the Goshen Board of Trade, the Police Athletic League, the Parent-Teachers Association, and the Executive Board of the Boy Scout Council. He is a director of the Newburgh Chamber of Commerce, Vice President of the Board of Education, and a director of the Community Chest. He is also County Director of Communications and Chairman, City Communications Civilian Defense. And this is not a complete list!

Further light can be thrown on the picture of telephone people engaged in spare-time civic work by citing a few more specific examples—condensed, for the sake of brevity, into headline form. Taken at random—and based of course on actual fact—the following are particularly illustrative of variety: chief operator serves as church organist; employees send radio sets to Veterans Hospital; service representative named county chairman of TB Seal

Street scene—in almost any community, large or small, throughout America. Telephone men practice courtesy on the road campaign; installer, member of Junior Chamber of Commerce, handles safety parade; telephone woman is delegate to Woman's Club Congress in London; operators dress dolls for underprivileged girls; Plant woman serves as president of Woman's Service Club, works with deaf children; manager is chairman of local United Health drive; and Traffic Girls Club raises $175 through candy sale for charity.

An amazing list? Yet it represents only a portion at best. However, it serves well enough to indicate clearly the extent to which telephone people pitch in on the home front—willingly, unselfishly, and with a natural desire to help out wherever there's a need.

In addition to these off-hour good neighbor activities, telephone folks have many on-the-job opportunities to serve their communities. This applies particularly to the men—the installers and the construction crews, the drivers of the familiar telephone trucks—who are working in and around the community all day long. That's why the telephone man always seems to be Johnny-on-the-spot in times of emergency. Again, it's the basic characteristic of his job and the places he visits on routine assignments that present him frequently with the chance to be of service to someone in time of need. He does nothing other good citizens wouldn't do—he just happens to be there; he has been trained in first aid as part of his job; and he is accustomed to acting quickly in emergencies.

Take the case of repairman Paul Speight, of Detroit, for instance. He happened to be driving by in a company truck at the precise moment an eight-year-old boy, in a tree house 30 feet above ground, was in dire danger of burning to death.

A fire had started in a mattress in the arboreal shack, and the youngster's clothing was suddenly ablaze. Below him a crowd gathered, helpless and apparently paralyzed with fear. This was the situation as Speight arrived on the scene.

Immediately he turned his truck off the highway and pulled it up to the tree. He quickly grabbed a ladder from his vehicle, climbed up to the terrified boy, and carried him down to safety—all in a matter of seconds. The flames were beaten out, and Bobby was rushed off to the hospital. Today, young Mr. Martin's wounds have healed, thanks to the happy presence and cool-headed action of Paul Speight.

A ladder was the key prop in another drama starring a telephone man. In this case it was Lawrence Alvord of Harrisburg, Pa. He was called into action by an excited mother, whose 2-year-old son had accidentally locked himself in the bathroom and was busy exploring the contents of the medicine chest with the natural curiosity of a lad his age. He was stoically ignoring the pleas of his frantic mother—so she turned to Alvord, who was working on a line nearby.

Alvord grabbed his ladder, put it up to the bathroom window, removed a pane of glass, unlocked the window and entered the room. The little fellow was restored unharmed to his anxious mother. Installer

Alvord replaced the window pane and returned to his job.

Friendly Service

INCIDENTS of friendly, helpful service—the seemingly small acts that employees perform on the job almost without a second thought—are rarely material for headlines. They're not dramatic nor are they extraordinary in a strict sense. They are simply the "extras" of courtesy and coöperation that any good neighbor might perform. And they happen every day—many times—in our business.

It is no secret that our employees' treatment of customers is important. It is an accepted premise that our customers want three things in return for their money: good service, improving service, and service that is friendly, courteous, sincere. They want to deal with people who are not only competent but pleasant, easy to get along with; they welcome a bit of special attention to their own particular problems.

And that precisely is the kind of service we try to give. It comes easy, for it's founded on a natural human desire in most people to act in a neighborly fashion.

Telephone people make headlines—and these typical news stories point up the variety of their good neighbor activities both on and off the job

All telephone people working at jobs that call for daily personal contact with the public play a part in this phase of our good neighbor activity. Many of the little "extras" performed by the installer, the operator, the teller at the business office, are routine—they're taken for granted and they go for the most part unnoticed. On the other hand, a customer who has received the kind of treatment he likes is often sufficiently impressed to take time to write a letter of commendation, singling out a specific action on the part of some employee for praise. As a result, the telephone company mailbag carries letter after letter from customers moved to put pen on paper by some small act of courtesy or helpfulness or neighborliness.

A CUSTOMER in Denver wrote to say that the job done by an installer in his new home was "at once so markedly attractive and so satisfactory—in both physical and mechanical sense—that I am impelled by the strongest sense of gratitude to send a word of formal testimony."

Another letter cited the helpfulness of an installer. It came from a woman customer in Montoursville, Pa., and referred to Lawrence Gee, who had visited her home to make a change in the telephone instrument. It said, in part: "While he was here, I called his attention to the telephone near the bed. The shut-off seemed to interfere with my radio, and since I am an invalid, both radio and telephone mean a lot to me. I would like to recommend this young man for his kind and cordial treatment. He found the trouble and fixed it."

A public office representative in Philadelphia was commended for the "patient and courteous service" received by an Army officer at the Frankford Arsenal. He wrote, "What a pleasure it is to do business that way. She [Mrs. Margaret Young] had all the desired information at her finger tips and, instead of showing signs of boredom or disgust, seemed happy to help in any way."

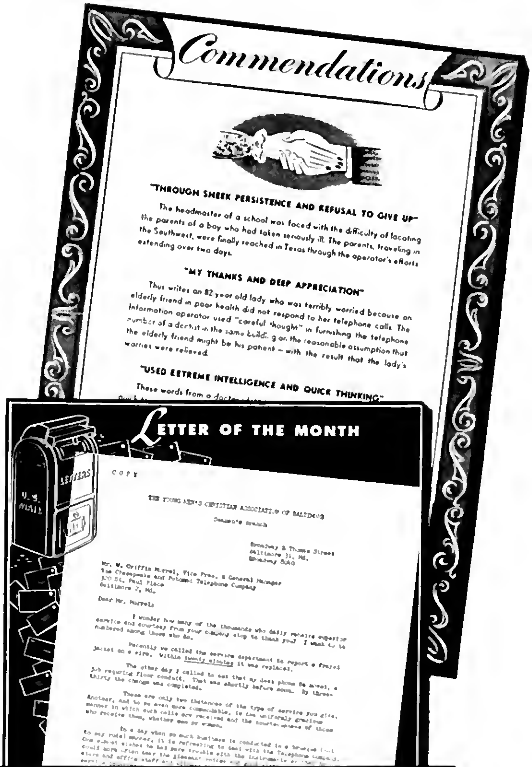
Operators, both local and Long Distance, come in for a lion's share of praise from our customers, since they have best opportunities to be of service every hour of the day, every day of the year. For example, the service and coöperation he received on a number of important business calls prompted an El Paso, Texas, business man to write: "I had considerable trouble contacting some of the parties who were most important to me. It was only through the patience and help given me by your operators that I was able to complete these calls. This made a great impression on me. Your operators exhausted every effort and clue in locating my parties for me. I want you to know you have people in your employ who make a special effort to render good service."

These are but a sampling of the many ways in which telephone people can and do act in a friendly, helpful way in the normal conduct of their jobs and in their personal contact with the public. They are daily supplying the third ingredient of service that the public wants; they add the seasoning of courtesy and pleasantness to speed, accuracy, and efficiency.

Service in Emergencies

EVERY DAY, everywhere throughout the country, emergency calls of varying nature are put through with speed and sureness by the ladies of the switchboard—the telephone operators.

Emergency calls for the fire and police departments, for ambulances and doctors, are not in the least unusual. They are considered—and properly so—as a routine part of the day's duty. They involve, for the most part, calls in which the caller gives complete information—what is wanted and why, the address, and other vital facts. Operators are trained to handle these quickly and efficiently, and as a result they do not constitute anything extraordinary—even though a life may hang in the balance.



Letters from grateful customers, commending the people who serve them, are frequently published in company magazines or used in bulletin-board posters. These examples contained letters from a headmaster, an elderly lady, the YMCA, and the state police

The type of emergency call that points dramatically to the essential rôle of the operator in time of trouble is the out-of-ordinary call—the one from a person desperately in need of immediate help, like the one from Angelo Chester. It is commonplace today for people faced with danger of some sort to turn instinctively to the telephone for assistance. In many cases, all the operator will hear is a gasp, or a half sentence, or simply silence on an open line. Any one of these indications, however, is enough for an operator. It's her signal to move, with a sure knowledge of what's to be done, and with swift and capable hands to do it. Here is where her experience and training come into play; here her calm and her alertness may save a life.

A business man of Detroit can attest to the importance of a single telephone call and the resourceful manner in which it was handled by operator Stephanie Lukach. He tells this story himself, in a letter written to the telephone company. It reads this way:

"I owe the telephone company and one of your operators a very deep and sincere debt of gratitude. I am 62 years old and for several years have had an internal ailment. I began to be bothered by this ailment and arranged to see my doctor. The morning of my appointment, when I tried to get out of bed, I realized I was a pretty sick man and needed help. I tried many times to

The alertness of an operator, the kindness of an installer, and the courage of a lineman were the subjects of these Bell System advertisements, seen by millions of national magazine readers make the five feet to the telephone, but each time I would fall in a faint. It was around noon that I did manage to pull the telephone down on me by its cord and dial the operator. I must have given her the numbers of my office and my doctor and that of the hospital where I had previously been treated. The next thing I remember was one of the men from my office standing by my bed. Then a doctor from the hospital appeared and then two police officers. I was bundled into an ambulance, taken to the hospital and remained twelve days. So will you please convey to the young lady who handled that call my very deep gratitude for the prompt and efficient way in which she helped me stay alive. But for her I very probably would not be typing this letter."

Two elderly women of Natick, Mass., owe their lives to telephone teamwork. The close coöperation and quick actions of an operator and a repairman combine to make this exciting story:

A light flashed on, operator Geraldine Sterling answered—but there was no response. Sensing quickly that something was wrong, Miss Sterling notified her supervisor, who quickly called the Plant Department. A test indicated that the receiver was off the hook. Repeated ringing on the line brought no answer.

Seconds later Repairman James R. Barnes, at work in the vicinity of the trouble, had been dispatched to the old apartment house where the telephone was located. He knocked, rang and called, got no answer. Then, having learned that the telephone was in the apartment of two elderly sisters, he tried the door. It was unlocked. He walked in and ran up the stairs, guided by the smell of gas.

The two old ladies lay unconscious—and beside one of them was the telephone with the receiver off.

Barnes went to work in a hurry. He turned off the gas under the pot on the stove that had boiled over and extinguished the flame. He threw open the window, rushed out, and with his test set called police. Firemen also came with a pulmotor and the two victims were removed to the hospital—still in danger, but saved from certain death by telephone teamwork.

The Priceless Asset

The good neighbor activities of telephone people—at work and at home—constitute an element in the telephone business that sets us apart from most other industries. It adds to the elements of good service, efficient methods and astute management the priceless asset of the human element—the warm, understandable side of a vast enterprise.

That the Bell System is proud of its people needs no documentation. Their multi-fold activities as good citizens and neighbors speak for themselves. They are highly valued in their own communities. We speak of them in the Bell Telephone Magazine, in magazines and newspapers, and on the radio so that those concerned may realize how widely appreciated their efforts are.

Our customers know us principally through our people. The more they know about the large force of men and women who serve them, the more they are likely to coöperate with them in their great task of enabling anyone to communicate with anyone else, quickly, clearly, anywhere, any time.

Traffic Control Bureaus Stand Guard Over Long Distance Facilities Which Are Doubly Important to the Nation in These Critical Days

Reweaving the Long Lines Circuit Fabric

Charles W. Hadlock

THE TOWN was playing host to a convention, and thousands of visitors motored in from miles around. Traffic gradually choked the streets. A narrow bridge on one of the main roads could not handle the abnormal stream of vehicles. Another highway was under repair and the one available detour route could not smoothly accommodate the unusual burden thrust upon it.

People wished that the streets could suddenly be made wider, that a few extra highways might miraculously appear in the right locations—and that the same magic somehow might return the roadways to normal when the emergency was over.

Had these things come to pass, they would have made world headlines. Actually, rearrangements of a comparable sort did take place during the convention period. But they went unnoticed, because they happened on the "voice highways" carrying long distance calls in and out of the town.

Unlike traffic arteries of asphalt or cement, the nation's network of long distance circuits can be temporarily rearranged or adjusted to meet variations from normal. Some of these changes can be planned in advance, as for a scheduled convention. Other adjustments, however, must be made almost on the spur of the moment to meet sharper and unpredictable changes in traffic flow. Such occurrences might be occasioned by train wrecks, flash floods, catastrophic fires, or similar happenings. Or a steam shovel might cut a cable and affect as many as 1,000 circuits.

Another requirement for which the bureaus must nowadays be constantly and particularly alert is the unanticipated large-scale movement of troops. The bureaus' quick response to the men's need for communication facilities supplements on a temporary basis the broader responsibility of planning and maintaining the nation-wide circuit layout to meet the nation's needs.

Paralleling these abnormal situa-

This picture of the Traffic Control Bureau in New York shows an actual scene of orderly activity during a major traffic emergency

tions are the temporary circuit changes related to planned work which must also be coördinated. Such instances may involve the completion of new outside construction—a new cable, or development of working cables or lines, for example. Temporary revisions in circuit layout may also be necessary to permit the release of message circuits for testing and rearrangements related to a new No. 4 toll switching system, cutovers to dial operation, new direct groups, and other such operations.

Meeting Each New Demand

UNDER today's overloaded plant conditions in the Bell System, the utmost use must be made of all facilities. Concentrating upon a particular aspect of this general problem are the men and women of the three Long Lines Traffic Control Bureaus, located at New York, Cleveland and Chicago.*

Telephone engineers plan the long distance circuit layout to provide an adequate number of circuits in each group to keep traffic flowing smoothly to and from all points under normal conditions. This they do on the basis of estimates of future trends and of the level of traffic volumes. But no day passes, in the coast-to-coast-and-border-to-border expanse of this vast country, without wide deviations from the esti-

* The Associated Companies maintain Traffic Control Bureaus at Boston, San Francisco, Norfolk, Richmond and Washington.

mated conditions for which the circuit layout was planned.

Therefore, as variations occur, the Traffic Control Bureaus have to rearrange the circuit layout so that the extra traffic on a particular group will cause the least possible delay to the customer. In short, it is their job to fit the available circuit layout to the current public demand for service.

THOSE FEW WORDS make the job sound simple; but the growing complexity of the circuit layout, the judgment required, the records which have to be kept, and the people and departments involved when a temporary rearrangement is undertaken, make the job anything but simple.

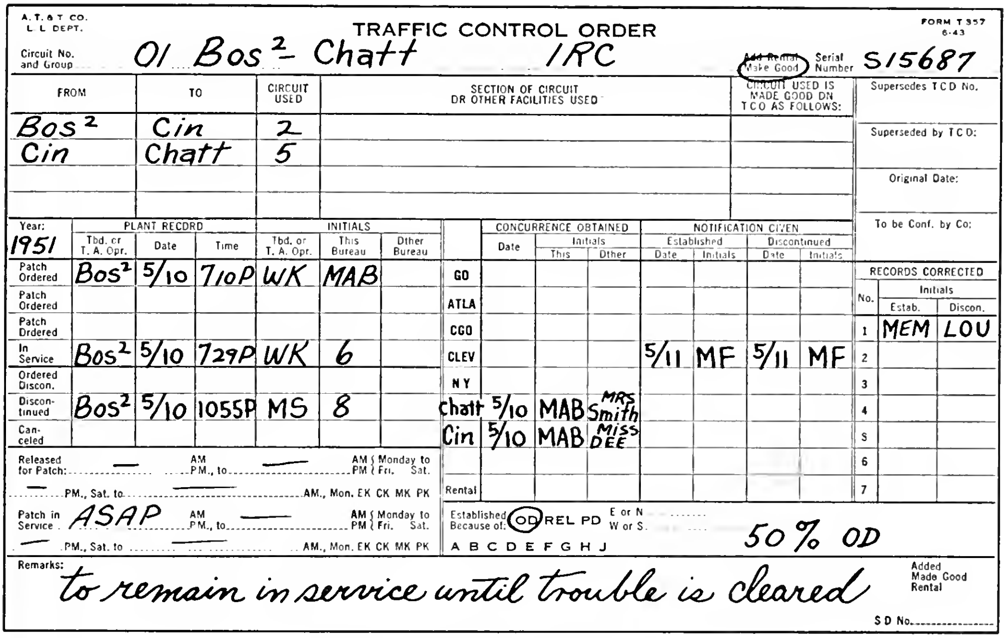
This fact is perhaps most readily evident when considering the responsibilities of the three Long Lines bureaus. For they must keep a constant vigil on more than 27,000 circuits which are scattered throughout more than 2,450 circuit groups and cover about 14,000,000 circuit miles. As the number of circuits continues to grow and the circuit design changes, the job becomes more complex. A dozen years ago, there were only 7,000 circuits in 1,600 groups, and the average circuit length was 250 miles, while today it is about 500 miles. To keep track of this tremendous number of "voice highways," many records of Long Lines circuit facilities are kept in each bureau for the circuit groups which are in their area.

A display board is also used at each bureau to provide up-to-the-minute information about every circuit terminating at the principal offices. This board shows the principal traffic offices in each bureau's territory and each circuit and circuit group in that office. Opposite the name of the circuit group, open "jacks" (holes) denote authorized working circuits. Variously colored plugs are put in these holes when circuits are out of, or added to, the layout for particular reasons. *White* denotes circuit trouble; *red,* released for transmission of radio programs, testing, etc.; *blue,* used to make good another circuit; *green,* provided by Control action. If a posted delay is in effect on any circuit group, this is also shown on the board. By looking at the display board, a trained eye can tell at a glance the condition of the entire circuit layout, and from such examination judge what, if any, action is required.

Replacing Circuits "In Trouble"

AS AN EXAMPLE of a circuit rearrangement, let us assume that the Boston traffic office receives a report from the Boston Plant Department that the "01 Boston-Chattanooga" circuit is "in trouble" (i.e., damaged or otherwise unserviceable), and that it is unlikely the trouble will be cleared for some time. These details would be transmitted promptly by teletype to the New York Control Bureau, since the Long Line circuits terminating in the Boston traffic office are under control of the former. This out-of-order circuit condition would be posted immediately on the bureau's display board.

The Control people, knowing that the Boston-Chattanooga circuit group is especially important to service men at Fort Devens, Mass., realize that



A. T. & T. CO.
L. L. DEPT.

TRAFFIC CONTROL ORDER

FORM T 357 6-43

Circuit No. and Group: 01 Bos 2 – Chatt 1RC

Make Good — Serial Number: S15687

FROM	TO	CIRCUIT USED	SECTION OF CIRCUIT OR OTHER FACILITIES USED	CIRCUIT USED IS MADE GOOD ON T C O AS FOLLOWS:
Bos 2	Cin	2		
Cin	Chatt	5		

Supersedes T C D No.:
Superseded by T C O:
Original Date:
To be Conf. by Co:

Year: 1951	PLANT RECORD Tbd. or T. A. Opr.	Date	Time	INITIALS Tbd. or T. A. Opr.	This Bureau	Other Bureau
Patch Ordered	Bos 2	5/10	710P	WK	MAB	
Patch Ordered						
Patch Ordered						
In Service	Bos 2	5/10	729P	WK	6	
Ordered Discon.						
Discontinued	Bos 2	5/10	1055P	MS	8	
Canceled						

	CONCURRENCE OBTAINED Date	Initials This	Initials Other	NOTIFICATION GIVEN Established Date	Established Initials	Discontinued Date	Discontinued Initials
GO							
ATLA							
CGO							
CLEV				5/11	MF	5/11	MF
NY							
Chatt	5/10	MAB	MRS Smith				
Cin	5/10	MAB	MISS DEE				
Rental							

RECORDS CORRECTED No.	Initials Estab.	Discon.
1	MEM	LOU
2		
3		
4		
5		
6		
7		

Released for Patch: — AM PM., to — AM PM { Monday to Fri. Sat. — PM., Sat. to — AM., Mon. EK CK MK PK

Patch in Service ASAP AM PM., to — AM PM { Monday to Fri. Sat. — PM., Sat. to — AM., Mon. EK CK MK PK

Established Because of: OD REL PD E or N W or S. 50% OD
A B C D E F G H J

Remarks: to remain in service until trouble is cleared

Added Made Good Rental

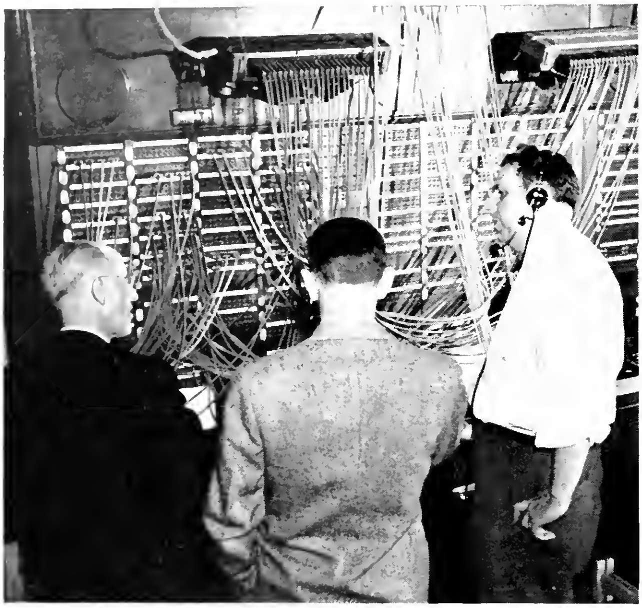
S D No.

A typical Traffic Control Order

it should be "made good" with the least possible delay. They proceed, therefore, to choose facilities from the national network which can best be used to replace the out-of-order circuit.

For the purpose of this illustration, we shall assume that a Boston-Cincinnati and a Cincinnati-Chattanooga circuit are chosen as the ones to be used to "make good" the out-of-order circuit. After the Cincinnati and Chattanooga traffic organizations have agreed to release the facilities needed by the bureau, a *traffic control order* is issued.

Next, the order is transmitted to the Plant testboard at Boston, which is the Plant circuit control office of the circuit to be established and, as such, is responsible for producing the over-all circuit. The testboard there passes the order to the other testboards concerned—in this case, Cincinnati and Chattanooga. Each of these offices now proceeds to do the work which is necessary to put the parts of the circuit together and terminate the circuit at both ends on proper switchboard drops. Sometimes the simple process of connecting the two parts together by patch cords at the intermediate office is all that is required. This may be done either at a special patch board designed for the purpose, or at the carrier bay, repeater bay, or the secondary testboard itself. In any event, the new circuit is produced by one or a combination of the actions described. The factors controlling the processes involved in establishing traffic control order circuits are many and varied, and in the last decade have become increasingly complex.



Patching cords weave new connections at a Long Lines Plant testboard in response to a Traffic Control Order established to meet an emergency

Many situations require give and take between widely scattered offices in order to even out posible delays to traffic movement. Judgment can be based only on a view of the picture as a whole, which makes it important that a Control Bureau be in contact with each of the traffic offices in its particular area and with each of the other Control Bureaus. This is done by teletype, over which information regarding traffic and circuit conditions is constantly passed to the bureau from traffic offices in the bureau's area. The bureaus pass information to each other over another teletype network. In case of a major failure, when a large number of circuits are lost, a full-period telephone circuit is also available to tie the bureaus together for conference purposes.

New Plant, New Methods

THE TYPE of plant used to provide long distance circuits has been changing rapidly during the past ten years, which means that the type of failure which the bureaus must adjust for has also changed.

Not so long ago, when open wire and voice cable facilities provided most of the message circuits, a wire break or even a truck knocking over a pole on a line meant the loss of a relatively few circuits. Today, however, with the use of carrier systems, as many as six hundred circuits may be obtained on one pair of coaxial tubes. This means a great concentration of circuits over main cable routes, so that when a major failure occurs, as many as 1,000 circuits may be in trouble. On the other hand, when such a situation arises nowadays, rearrangements of *channel groups*, a group of twelve circuits, are made when practicable. Hence this procedure makes good twelve or more circuits at one time, while formerly one rearrangement yielded but one circuit.

The effect of conversion to operator toll dialing upon the rearrangement work has not changed Control Bureau objectives, but it does require a more careful choice of facilities. The bureaus now need to use more engineering data, because of the different types of equipment used on circuits arranged for dial operation. Therefore, the processing of individual rearrangements is generally slower than for the older type of circuits.

Meeting Military Requirements

DURING these times of defense activity, the bureaus are constantly shifting facilities to take care of increased traffic from military camps to various parts of the country. Calls from most of the military camps have increased at such a tremendous pace that it has not been possible in all instances to provide the necessary facilities required to set up new circuits. However, the bureaus are generally able to provide the operating forces with the necessary circuits to keep the traffic moving. This is in part accomplished by setting up night and week-end circuits from these posts to the various parts of the country.

Most long distance calls are placed, and consequently the maximum number of circuits are needed, during the morning at some traffic offices and during the afternoon at others. A large percentage of this peak traffic load originates with business customers, and the big majority of the circuits required to handle this type of traffic are between industrial areas. The largest concentrations of the military camp traffic originate, on the other hand, during evening hours and over week-ends. Since this traffic is of a social nature, it has quite a different pattern from the daytime usage.

It is these two different types of traffic which make it possible for certain circuits to do double duty: to carry the one kind of calls during business hours and then to be reassigned to meet the calling needs of the men at military establishments at other times. Where permanent rearrangement of circuits is not needed, the bureaus can issue "patch orders" for night circuits. In such an instance as that just cited, the Plant offices establish the circuits on a

This section of the Traffic Control display board shows the circuits which are used for toll line dialing routine basis every day and for week-ends to handle the two varieties of calls.

The traffic from military camps must be kept under steady surveillance, since it is constantly changing. One example will illustrate the point. A National Guard unit from the State of Oklahoma was sent to Camp Polk, near Leesville, La. Traffic from the camp to Oklahoma communities increased to such an extent that it was necessary to set up new direct night and week-end circuits from Leesville to Oklahoma City and Tulsa, in order to handle the calls efficiently. When this unit moved, the direct circuits were discontinued and traffic was again completely handled on the normal authorized routings. However, a unit composed of men from Texas points arrived at Camp Polk not long thereafter, and again there was a requirement for new direct groups from Camp Polk—this time to Dallas and Houston.

Seasonal and Holiday Shifts

One of the big problems for the New York bureau during the winter months is the very heavy increase in traffic from the Florida winter-resort area. During this season, weekly conference calls are held between the Long Lines Control Bureaus and the Southern Bell Telephone and Telegraph Company offices which handle the resort traffic in Florida. The purpose of these conference calls is to review the efficiency of the circuit layout and shift it about, if required, to provide the most efficient as well as satisfactory use of all the groups involved.

In coöperation with the engineers, the bureaus also rearrange the layout to provide a maximum number of circuits for handling traffic on the major holidays. Last Christmas, the bureaus provided approximately 1,000 circuit additions to heavily-loaded groups. Some of these circuits were obtained by using the facilities assigned to 250 full-period circuits which are normally used to furnish private full-time service to banks, stock brokers, and large industrial firms but were not in use on the holidays. The rest of the facilities were obtained by reassignment of message circuits in commercial traffic groups, and by the use of facilities temporarily spare as a result of circuit order work. The holiday layout was arranged to include about 250 new direct groups which by-passed congested switching offices and were operated in general on a one-way basis to handle traffic originating at small toll centers.

Some of the other functions of the bureaus include engineering certain types of conference calls which involve either regular message or TWX service. The bureaus also summarize the monthly *toll line usage* data, which are useful in determining those circuit groups that are too heavily loaded and need circuits added to them to handle the traffic properly. Another service is to furnish routes to the operating forces for infrequently called places not listed in the Toll Rate and Route Guide.

The bureaus are kept very busy at the present time owing to the large increase in traffic and to congested plant conditions. They are

The teletypewriter installation in the New York Traffic Control Bureau provides communication facilities to all the other Bureaus and to the Traffic offices within the New York Bureau's area

attempting to make the most efficient use of the circuit mileage available, in order to keep bottlenecks from slowing service because of extra traffic from areas in which industrial activity has greatly increased or a shift in population is occuring. During an average month, the three Long Lines bureaus make 1,500 circuit rearrangements, and release 5,000 circuits for short periods for various reasons. These include such matters as Plant testing, circuit order work, and special circuit requirements.

THE ASSOCIATED COMPANY Control Bureaus maintain a "watch" over their own toll layouts in much the same way, and offer a natural supplement for the Long Lines circuits terminating in the Company which they serve. These bureaus provide service information to Long Lines bureaus and assist in reviews of rearrangement possibilities, thereby expediting the work through a single Long Lines contact in that Company. This teamwork makes it possible for the Associated Companies and the Long Lines Department to integrate their facilities with comparative ease, and is still another factor in providing the people of this country with the surest and quickest as well as the most and the best telephone service in the world.

"Signal Venture"—A Book Review

By Carroll O. Bickelhaupt

Brigadier General, AUS (Retired); Vice President and Secretary, A. T. and T. Company

Signal Venture, which started out to tell the story of the planning and execution of the long-distance military communications for the invasion of north-west Europe in 1944, turned out to be a narrative of the personal experiences of the author as a linesman with the Royal Australian Corps of Signals during World War I; as a telecommunications engineer with the General Post Office of the United Kingdom during the period between the wars; as a Signal Officer, Royal Corps of Signals, British Army, in the early days of World War II, through the retreat from Dunkirk, in the planning for the defense of the British Isles from the threat of German invasion and for the invasion of continental Europe; and, finally, as Chief of the Telecommunications Section, Supreme Headquarters, Allied Expeditionary Forces, and a member of the great international staff at SHAEF.

Brigadier Harris' book is thrilling, immensely interesting, and fascinating reading. It not only paints a picture which will inspire Signal men and Signal officers everywhere, but it is "required reading" for all who are interested in military signal communications from the battalion to theater headquarters and should be read by all who have a broad interest in long-distance telecommunications. Members of the Signal Corps, U. S. Army, who participated in the planning for "Operation Overlord" will appreciate Brigadier Harris' dry comment, "I do not think we ever considered Americans as foreigners in quite the ordinary sense. . . ." Americans, on the other hand, may have some difficulty with Brigadier Harris' casual and typically British use of official initials, but many of these designations are old friends to those who served in Europe during World War II and bring to the reader the flavor and atmosphere of signal operations.

As one who worked with "Brig" Harris during the trying and difficult days from the liberation of Paris to V-E Day, I recommend Signal Venture to students of telecommunications, both military and civilian, to students of modern warfare, and to those who like to read a thrilling tale of high adventure and difficulties overcome.

Signal Venture, by Brigadier L. H. Harris, C.B.E., T.D., M.Sc., M.I.E.E.* Gale & Polden, Ltd., Aldershot, Hampshire, England, 1951. 18 shillings ($2.52).

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* Commander British Empire; Territorial Decoration; Master of Science; Member, Institute of Electrical Engineering.

Welcome to Great Britain

From the *Telecommunications Journal* of the Post Office of the United Kingdom

It is our special pleasure to offer, on behalf of our readers who work in the telecommunications services and industries in this country, a warm welcome and sincere good wishes to Mr. Gifford on his taking up duties as U. S. Ambassador in London. President Truman has selected for this post a man who has made his name in the sphere of telecommunications. Under his wise leadership as President and Chairman of the Board of Directors of the American Telephone and Telegraph Company for many years, he has seen the great telephone system of the U. S. A. mount from 11 million to 33 million telephones, in spite of the handicapping difficulties of two wars. It employs over 600,000 people. The responsibilities attaching to his office must have demanded great technical knowledge and the display of courage, foresight, sympathy and understanding. These qualities will be no less required for the task to which Mr. Gifford has now set his hand. Telecommunications people everywhere, one of whose special jobs it is to enable Nation to speak to Nation, will join us in wishing Mr. Gifford all success in his efforts to secure peace and understanding amongst the nations of the earth.

A Day to Remember

You awoke in your room beneath the eaves, and, as boys do, you lay there quietly for a moment, listening to the sounds of spring all about you . . . the clamor of the bluejays in the big maple tree just outside your window . . . the bark of a dog frisking in the meadow. Then you tumbled out of bed and into your clothes.

You hurried down the stairs and into the back yard. Everyone else had been up for hours. And then you realized—this was not just another golden morning in spring. And you followed along behind Grandma and Aunt Sue and helped them fill the big clothes basket with flowers from the garden . . . for this was Memorial Day . . . and you had kinfolk to remember.

Some of them lay in the family plot on the hill just outside town—your own uncles and cousins brought home to heroes' rest. And there were others, buried where they fell, in far-off lands—names in the old family Bible.

There would be a parade down Main Street at noon. The Firemen's band would play a Sousa march, and the whole crowd would follow the parade to the Soldiers and Sailors' Monument by the Courthouse. You remember how the music turned slow and sad and then died away. For a moment you couldn't hear the least sound anywhere in the crowd—and then you heard the volleys as the National Guardsmen fired their salute to the honored dead . . . and you heard the echoes clear across the town.

A day for remembering . . . and in the late afternoon you walked home from the quiet hill just outside the town . . . and you sat on the front porch as the cool of evening came on—and listened to Grandma talking on the telephone in the hall . . . telling the cousins over in Webster County that this had been the most beautiful Memorial Day . . . and then Aunt Sue would call her sister in Chicago . . . the one whose boy had fallen in the Argonne . . . and you would hear Grandma and Aunt Sue talking—keeping their voices kind of low. Because this was a day they wanted to be as close to their folks as possible.

And as you sat there in the growing dusk, you saw the first pale star of evening gleam out—the soldier's star, your uncle called it—and your eyelids closed . . . and then Grandma was shaking your shoulder gently . . . and as you stumbled sleepily up to bed, you heard her say . . . "Another Memorial Day has come and gone."

"Telephone Story" on the Telephone Hour radio program

Laboratories Develop New Master "Timekeeper"

A NEW and extremely precise "master timekeeper"—probably the most precise in existence—has been placed in operation by the Bell Laboratories at Murray Hill, N. J. A result of five years' effort on the part of Laboratories engineers, the new timekeeper serves as a yardstick for the precise measurement of frequency and time throughout the Bell System. It is expected to vary less than one ten-thousandth of a second per day; this corresponds to a precision of one second in 30 years.

The apparatus is used to monitor or regulate equipment for the coaxial cable and radio relay television and telephone networks, as well as overseas, ship-to-shore and mobile radiotelephone service. Radio broadcast network switching clocks are also controlled by this new device. The secret of its split-second precision lies in four extremely stable quartz crystals which vibrate constantly at a frequency of 100,000 cycles per second. The vibrations of these crystals control the frequency of a special electric current with a precision of one part in a billion.

The entire apparatus contains about 600 electron tubes and has well over 25,000 soldered connections. It is housed in air-conditioned rooms where the temperature never varies more than two degrees. The quartz crystals themselves—each about the size of a paper matchbook—are enclosed in containers from which all the air has been pumped out. These in turn are surrounded by thermostatically controlled ovens to maintain the temperature of the quartz crystals constant to within a hundredth of a degree.

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Autumn 1951

A Medium of Suggestion & a Record of Progress

Published for the supervisory forces of the Bell System by the Information Department of American Telephone and Telegraph Co., *195 Broadway, New York 7, N. Y.*
Cleo F. Craig, *President;* Carroll O. Bickelhaupt, *Sec.;* Donald R. Belcher, *Treas.*

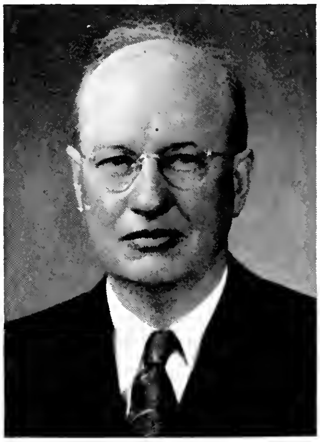
Who's Who & What's What *in This Issue*

The Bell System covers a lot of territory, and the man who undertakes to survey and report upon a System-wide activity finds he has quite a job on his hands. This is particularly true of the System's national defense activities, which ramify into just about every department of the business. F. R. Kappel is in a good position to observe this nation-wide effort in broad perspective, because since 1949 he has been the A. T. & T. Company's Vice President in charge of the Department of Operation and Engineering. Twenty-five years before that, he had started with the Northwestern Bell Telephone Company as a groundman, and in the next nine years had served in Plant, Engineering, and Commercial posts in the Minnesota Area, becoming equipment and building engineer in 1933. Three years as plant engineer in the Nebraska-South Dakota Area prepared him for his headquarters assignments in Omaha, beginning in 1937, where he was successively plant operations supervisor, assistant vice president, and Operating Vice President. He moved to New York and the A. T. & T. in 1949, and this proved to be a busy year for Mr. Kappel; for he was an assistant vice president in the Department of Operation and Engineering, and then Vice President in charge of the Long Lines Department, before he assumed his present responsibilities in November of that year.

No end to the spiral of inflation is yet in sight, and it is Charles E. Wampler's responsibility, as A. T. & T. Vice President in charge of Revenue Requirements Studies, to keep a sharp eye on its effect upon the Bell System. With the System since 1929, he had both Traffic and Engineering experience in the Illinois Bell Telephone Company before he became an assistant vice president in Chicago in 1948. The following year found him with A. T. & T. in New York, where, after serving for a period as assistant vice president in the Personnel Relations Department, he was made General Manager of the Long Lines Department. He was elected to his present

F. R. Kappel

Charles E. Wampler



Oliver E. Buckley

C. C. Duncan

Richmond B. Williams

position last July. Mr. Wampler's telephone career has had several interruptions. Twelve years ago, he took a year of graduate work at Massachusetts Institute of Technology. Two years later he went to Washington, D. C., to work with OPM and WPB. This was followed by a tour of Army duty, beginning in 1942, which included some months in France and Japan before he doffed his uniform in 1946 as a lieutenant colonel with a Legion of Merit award. Earlier this year he was on temporary assignment in Washington for several months with the Defense Production Administration.

Chairman of the Board of Directors of Bell Telephone Laboratories since April 20 of this year, Dr. Oliver E. Buckley at that time accepted President Truman's appointment as Chairman of the Science Advisory Committee of the Office of Defense Mobilization. In World War II, in addition to defense activities as President of the Laboratories, he was a member of the Communications and Guided Missiles divisions of the National Defense Research Committee. He is also a member of the National Inventors' Council and of the General Advisory Committee of the Atomic Energy Commission. During the first World War, commissioned a Major in the Signal Corps, he had charge of the Research Section of that Service in Paris.

Dr. Buckley entered the Bell System in 1914 as a research physicist. In 1927 he became assistant director of research of the Laboratories, and was made director of research in 1933. He became executive vice president three years later, and was elected President of the Laboratories in 1940. He has contributed several articles to this Magazine, including "Bell Laboratories in the War" in the Winter 1944–45 issue, and in the Spring 1950 issue "Some Observations on Industrial Research."

The requirements of the nation's defense program have focussed attention on the need for conservation of metals and other scarce materials, and the Bell System is coöperating wholeheartedly in this conservation campaign. But conservation of materials in the Bell System is not confined to times of national emergency; it is, says C. C. Duncan, "the normal way of life." As supply practices engineer in the Plant Division of A. T. & T.'s Department of Operation and Engineering, Cliff Duncan is able to observe and develop many of conservation measures which are being

(*Continued on page 173*)

Salvaging copper for the Bell System's needs. The wire from the old line on Robert's Mountain, in Oregon, now replaced by cable, will be smelted down and re-used in the nation's telephone service. *See the article beginning on page 188*

Both Normal and Highly Specialized Operations Contribute Importantly to Civilian and Military Activities as the Country Continues in a State of Emergency

The Bell System's Part in Defending the Nation

F. R. Kappel

DOWN THROUGH THE AGES, means of communicating have been a major factor in the success of both offensive and defensive military operations as well as in civilian projects. Thus it is only natural that, ever since the telephone has become a part of everyday living, the Bell System has had a major role in both war and peace. It is traditional in the Bell System to be prepared for any emergency that might interrupt service. In keeping with this tradition, we are busily engaged in many special activities during the present defense effort.

There has been so little time since the end of World War II that it might seem reasonable to suppose that the procedures and arrangements developed for it could simply be dusted off and reapplied. All of these have been examined, but so many fundamental changes have occurred that the old ways are no longer wholly adequate.

The Regular Job

COMMUNICATIONS have always been essential to the manufacture and delivery of both civilian and military products. During the past several years the increase in complexity of these products, and particularly the tools of the fighting man, have complicated all the processes of fabrication, operation and servicing—with a consequent growth in the volume of communications as well as the need for speed.

The need for the Bell System to build substantial amounts of telephone plant, in order to meet the communication requirements of the nation, is much greater than it was at any time during or before World War II. The System is twice as large as it was then and is far more generally depended upon by all elements of the population for their daily work and their daily living.

The Bell System is meeting this challenge.

At the end of World War II, the Bell companies had a backlog of two million requests for service which had not been filled because facilities were lacking. The telephone plant was loaded more heavily than ever before. Since that time there have been continued high demands for additional telephone service.

To care for the backlog of held orders for service and meet this demand, the telephone companies have carried on continuously a large program of construction. Although this new construction and special measures to load the plant have made it possible to connect nearly 10 million additional main telephones, not all requests for service have been filled.

It had been expected that the held orders could be substantially cleared during 1951; but the upsurge of demand which began with the Korean crisis about the middle of 1950 has delayed that possibility, in spite of a construction program costing over one billion dollars this year. Limited copper supplies have prevented a greater amount of construction.

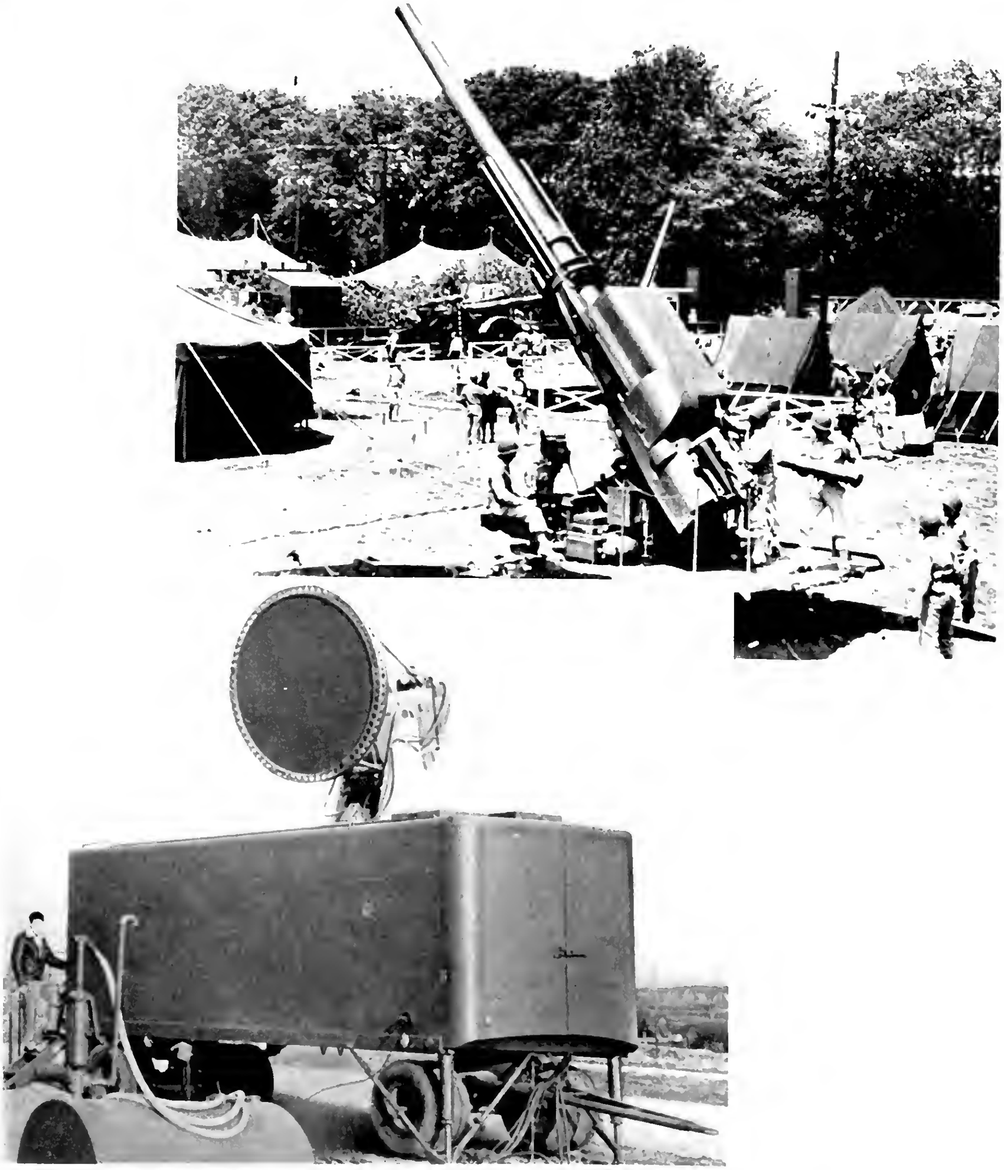
The growth of toll messages during and since World War II has been even more rapid than the growth of exchange service: an increase since the end of 1940 of 170 per cent. This has necessitated a great expansion and strengthening of the capacity of the toll plant. Since the Korean crisis, the rate of increase in toll messages is even more rapid than before, so that toll plant construction is being still further expanded. This service is particularly important for defense production, which relies heavily on fast toll service. Since the war, five and a half billion dollars of plant have been added to the five billion already in use—all of it now serving in this tremendous defense effort of ours.

Communications for the Armed Forces

Every branch of the Armed Forces depends on the telephone night and day. New and re-activated military camps and bases need a vast amount of telephone service and need it quickly. The integration of the whole nation into an armed unit requires a spider-web network of private lines connecting all important locations both for administrative purposes and for controlling the airplanes and anti-aircraft batteries so vital to defense.

Naturally, such requirements take precedence over other work, and military and essential defense requirements are being fully met. Often, to meet the time elements in a particular case, it is necessary to take switchboards intended for civilian service, or to take existing long distance circuits away from the telephone message service, and to replace them by building new plant as soon as time and available material will permit.

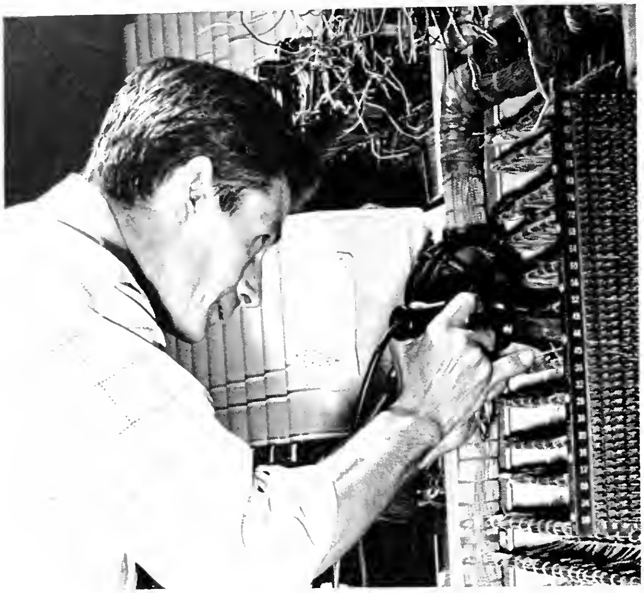
The Camp Atterbury project is a good example of the kind of job being done for the Armed Forces. The Indiana Bell Telephone Company and the Western Electric Company completed a 1,000-line dial P.B.X., 35 positions of long distance switchboard, and coin-box facilities to serve the 30,000-man capacity camp in one-tenth of the time normally required



One result of Bell System teamwork—Laboratories development and Western Electric production, in this instance—is a new and highly effective fire control system for anti-aircraft artillery for the Armed Forces

for such a project. Twenty-nine days after the first notification, the dial P.B.X. was in service, and the rest of the job was ready in the next two days.

In Washington, the Chesapeake and Potomac Telephone Company and Western Electric added 1,000 lines of dial P.B.X. equipment to the Pentagon board in less than one-third of the time normally required for such a project.



The tag reading "National Defense Order" helps speed the installation of this extensive dial PBX system for an airplane factory

Weapons for the Armed Forces

Another phase of the System program of active coöperation with the Armed Forces on items of front-line consequence is the work of the scientists at the Bell Telephone Laboratories, whose efforts have been unremitting to create new and more effective devices for military use.

The story behind the $150,000,000 of Army Ordnance contracts for development and production of an anti-aircraft fire control system is representative of the close liaison which has existed between military organizations and the Bell Laboratories-Western Electric team. After the end of World War II, the Army Ordnance Corps asked the Bell System to undertake research, development, and manufacture of the fire-control system not only because of its wide experience with gun directors and radar of World War II but also because of its unique qualifications in the field of electronics and in the complex switching mechanisms which underlie the dial system of the modern telephone network.

The new fire-control system is an outgrowth—with a great many refinements—of the famous Bell Laboratories-Western Electric electronic gun director and its associated radar systems, which proved so remarkably effective against planes and "buzz-bombs" in World War II. This earlier fire-control system, a major "secret weapon" of the war, worked almost entirely automatically. Radar found and "tracked" a hostile plane or projectile, and fed continuous information concerning its location into a computer, which was the brain of the system. At the same time, data relating to wind velocity, muzzle velocity of the shells, temperature, and similar factors, were given to the computer. This machine then automatically calculated where the shell should explode to bring the plane down, and aimed the guns to do just that.

The new fire-control system, adaptable to firing anti-aircraft batteries, operates on the same general principle as its predecessor, but many improvements have been incorporated. As a result, it is far more effective and flexible than the World War II version. It is, of course, geared to handle high-altitude high-speed targets, and to take into account advances in plane and projectile performance which have been made in the last few years.

Another "special" undertaking is that of the management of the Atomic Energy Commission's Sandia Laboratory. The purpose of this Laboratory, now a major facility, is: "to bridge the gap between laboratory development work and the manufacturing operations on atomic weapons." Sandia is operated on a non-profit basis by a subsidiary company of Western Electric.

Sounding the Alarm

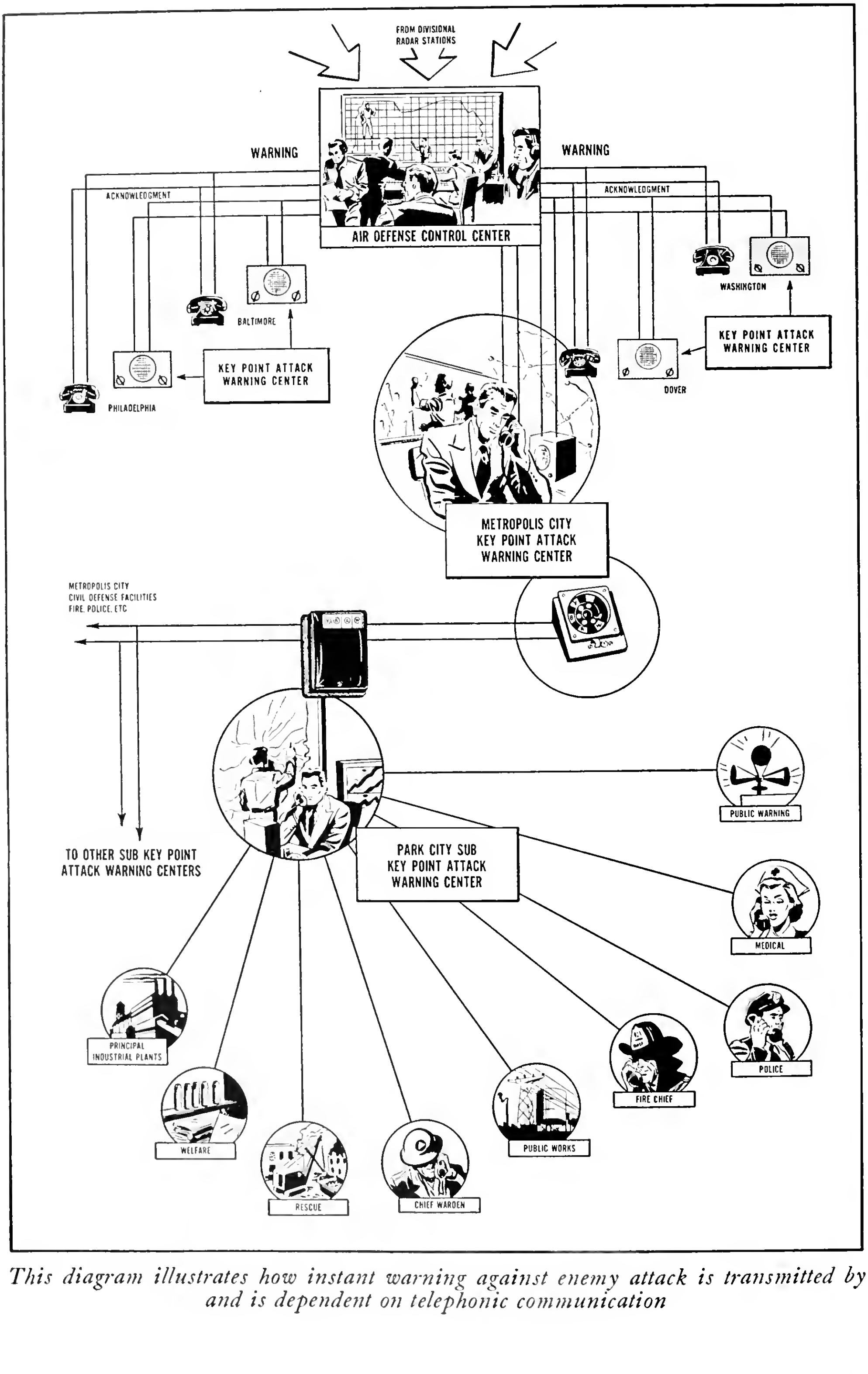
IN THE EARLY DAYS of the American Colonies, a lantern in "the old church tower" flashed the warning which Paul Revere carried on horseback to "every Middlesex village and farm" —perhaps a dozen miles. Adequate advance warning of an attack is infinitely more important now than it was then, and so today a tiny dot of light on a radar scope can start a chain of action that will alert the whole civilian population of the United States.

It took Paul Revere, on his horse, several hours to warn a few villages. Today it is possible to flash the warning to every city and town in the entire country and to sound the warning sirens in a matter of minutes.

World War II had its air-raid warning arrangements and attack warning systems, and these are with us again; but the simplicity of merely utilizing a chain of telephone calls has been outmoded by the increased speed of aircraft and the potentialities of guided missiles.

The Ground Observer Corps, the Filter Centers, and the Air Defense Control Centers—all dependent on telephone communication—have been re-established on substantially their

Operators at attended telephone locations at Army camps furnish a prized link with home and friends



This diagram illustrates how instant warning against enemy attack is transmitted by and is dependent on telephonic communication former basis but covering a much greater part of the country. The addition of a large number of radar sites which require communications for transmitting the information shown on radar scopes has greatly increased the requirements for private-line circuits.

As during World War II, attack warnings would be passed from the Air Defense Control Centers (ADCC) to geographically selected cities of the nation (called Key Point cities) and to military establishments. From these cities the warnings would be further disseminated. The same basic layout was set up when the Air Defense Command started operations in 1949; however, the much greater speed of aircraft now requires time intervals, and consequently a telephone system, much different from before.

The Air Force wanted to be able to warn all the Key Point Cities throughout the nation within two minutes and to receive acknowledgments from all the key points on each network within five minutes. By establishing private-line networks with loudspeakers at each Key Point, the Bell System, together with the Independent telephone companies, has more than met this objective. Similar networks are used to warn the important military establishments. The original toll terminal arrangement, using regular service facilities, is still available as an alternative method in case of need.

Private-line signaling networks have also been adopted for the dissemination of warnings from the Key Points to other cities and to all necessary locations such as civil defense organizations, police and fire departments, factories, etc. At the request of the Federal Civil Defense Administration, and through the usual close coördination between the A. T. & T. Company, the Bell Laboratories, and Western Electric, a new system for almost instantly sending the warning signal to practically an unlimited number of points was designed and the first units manufactured within four months from the time an agreement on requirements was reached with the FCDA representatives.

This "Bell and Lights" system, as it is called, is actuated by a dial at the control point, where an operator

Civil Defense Report Centers such as this gather and pass along damage reports to Control Centers for evaluation and action merely "dials the color" of the alert. At the warning station, the degree of alert is indicated both by lamps and a code-ringing bell. The system has a capacity for four degrees of alert—Yellow, Blue, Red, and White.

With this combination of private-line networks, it is possible for all desired points, from east to west and from north to south, to receive an attack warning within less than two minutes from the time the decision is reached at the Air Defense Control Center. The availability of the regular message telephone circuits, which in themselves are on various routes and well protected by telephone company diversification of facilities, as an alternative arrangement meets the need for back-up at very low cost.

Civil Defense

In addition to providing the means already discussed for sending out an alarm, telephone companies are deeply involved in plans of the Civil Defense Organization. Nation-wide telephone and teletypewriter networks are required, and cities in target areas are establishing detailed plans for preventive measures and for relief and restoration after an attack. These plans involve the establishment of disaster control centers which must be able to talk to police, fire, hospital, utility, and other vital services for coördination and direction of relief work.

These communications requirements are substantial, and offer a number of special problems. The Bell System is working closely with

Checking employees' identity is a precaution against the entry of unauthorized persons into telephone buildings

Civil Defense authorities at all levels—national, state, and local—to meet these needs with the most suitable tools: signaling systems; wire, radio, mobile, or point-to-point communications, all of which the telephone companies now have available in almost all large centers. A telephone man is part of the staff of practically every civil defense organization.

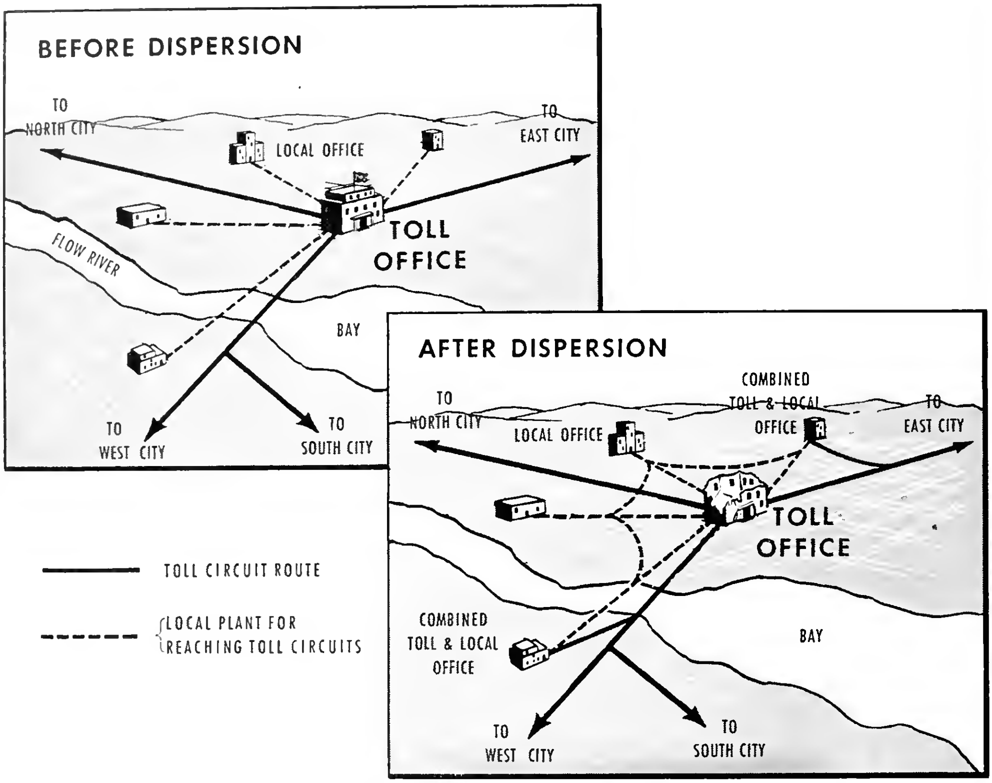
Shelters, drills, and first aid training are elements of protection for employees in telephone buildings

Continuity and Reliability of Service

IT IS ESSENTIAL to provide the service required, of course; but unless continuity is maintained and provision is made for prompt restoration of interrupted service, it cannot be said that the job has been done. Telephone companies face this problem constantly, and experience over the years has shown the necessity for building plant and arranging everyday operations to assure the maximum of service reliability.

The national toll network of the Bell System is widely dispersed over many routes and most of the large cities can be reached from several directions. Thus, if the normally used circuits are interrupted, alternative routes are immediately put in service and additional ones are readily available. As a matter of regular routine, strategically located traffic control bureaus are constantly informed regarding the condition of all major circuits. They are able to take action before serious delays occur.

Since World War II, coaxial cables having a capacity of many hundreds of channels, and radio relay systems with a potential capacity as great as or greater than the coaxial cable, have been installed on a large scale. Extensive use of these facilities has not only increased traffic-handling capacities but has provided diversification of routes and types of equipment. For example, seven separate transcontinental routes, employing all



Dispersion of telephone transmission facilities is an important factor in the ability to maintain continuity of service after enemy attack

modern types of facilities, provide a large measure of safety against serious interruptions to essential traffic. Another example is a radio-relay channel now being constructed from Boston to Philadelphia and Washington. It will follow a new route, completely by-passing New York City, and will thus make available a substantial number of direct circuits from Washington to the many important military and civilian installations in the New England states, no matter what might happen in New York City.

THOUGHTFUL attention is being given to means of avoiding even a temporary loss of all toll services in a large city, even in the event of complete destruction of the main toll centers. The general principle followed is to terminate a portion of the toll circuits in outlying buildings rather than in the main toll centers and to provide means of access to the local telephone offices in the city. The basic service for essential calls provided by these circuits would be supplemented rapidly by restoration measures.

The diversification of exchange plant is especially important to the communication services within each community. In this connection the vast network of cables (the principal ones being underground) and the wide dispersion of switching centers make for a system that inherently provides continuity of service even though a part of it is destroyed. In addition, the telephone companies have in service mobile radiotelephone systems in 67 major cities, serving more than 10,000 telephones in automobiles, trucks, boats, and other mobile units. This system, integrated as it is with the wire system, is a strong element of protection for essential service in an emergency.

In addition to the safety afforded by wide dispersion of facilities, adequate protection must be provided for buildings and for the people who work in these buildings. For many years, the basic design of telephone buildings has been such that they afford good shelter under existing hazards. They are usually of steel or re-inforced concrete frames, and all construction has been aimed at making them as fire resistant as practicable.

Provision of fire protection devices, well trained personnel, and frequent fire drills are part of regular telephone planning. Under present conditions, additional measures are required. Programs are under way for establishing, training, and equipping teams of workers for first aid, air-raid warden, rescue corps, fire fighting, and other protection specialists. The best locations in the buildings are designated as shelter areas. Measures are being taken to prevent unauthorized access to buildings, and all practical means of reducing the possibilities of sabotage are being put into effect. Protection measures are continuously being studied, with the full coöperation of several Federal Government departments.

Restoration Plans

THE POSSIBILITY always exists that any telephone office or trunk route may be seriously damaged or destroyed and, even for coping with natural disasters, specific plans must be available for rapid restoration of service. These plans have been carefully reviewed and brought into

Outworn telephone equipment of every sort is salvaged in the Bell System's standard program of conserving all kinds of scarce materials adjustment with the more serious conditions now facing us. The availability of mobile telephone service and over 100 strategically located emergency radio systems, which may be moved promptly to any location for service into a devastated area, both helps and speeds the execution of these plans.

Conservation of Materials

SOON AFTER the outbreak of hostilities in Korea, it became evident that the rapid build-up of the defense program would place unusual requirements on the supply of many critical materials. Steps were immediately taken by the Bell System to review its use of such materials and to see what measures might be taken to continue the programs already planned and still use as little of these materials as possible.

To date, measures have been instituted in the manufacture of telephone apparatus and equipment which on an annual basis will result in savings of the following magnitude:

Aluminum	15%
Copper	6%
Lead	15%
Nickel	30%
Rubber	15%
Tin	50%

Studies are continuing and additional savings will be introduced as they are found to be practicable.

In addition to the savings in equipment and apparatus design, development work has been speeded up on new types of carrier systems such as the "O" carrier which will be employed on open-wire lines and will be economical for much shorter distances than existing systems. The application of carrier to existing lines contributes very substantial savings in copper as compared to stringing additional wire. Everywhere, the plant is being loaded to the fullest extent practicable. Programs for the recovery of scrap are being actively pushed.* These and many other activities are all pointed toward doing the job with less.

Other Activities

ONLY A FEW of the many ways in which the Bell System is participating in defense activities can be even briefly described in one article. Many special projects cannot be discussed for security reasons. Still others are so important and so interesting that it would be impossible to do them justice in the space available here. The whole history can never be written; for it is made up of so many and such a variety of jobs, handled in all parts of the organization and so intermeshed with the daily routine, that many of them hardly show up except in the many extra hours of intense effort on the part of the entire team.

Teamwork

THE BELL SYSTEM TEAM—*design, manufacture, operation*—is functioning in high gear. Our job is a big one. We have the know-how, the personnel, and the leadership to meet the challenge—as we always have, with the best communication system in the world.

* See also page 188 & ff.

Increased Rates, to Assure Financial Health, Are Vital To the Bell System's Job of Meeting the Nation's Demand for Telephone Service

A Reasonable Rate Program

Charles E. Wampler

SUPPOSE somebody said this to you:

"Here's a rough outline of your job:

"First you will need to go out and get money for construction: you'll need enough to build telephone plant to the tune of about $4,000,000 per day until further notice.

"We want you to install about 1,000 new telephones every hour. Of course, this means putting in the cables, switchboards, and other equipment which go along with them. This will take a substantial part of the $4,000,000 a day.

"While you are doing that, remember we also need many more long distance lines. People are making more and more long distance calls, especially for production and defense. The lines are mighty crowded and all the new telephones that are going in will crowd them more than ever.

"Wherever there is a new or expanding defense plant getting into production, or a military training camp, or any project that is important to the country's security, we want you to get telephone service in *fast*.

"Also, you will need part of this money so that you can build more lines and switchboards to hook up radars, observation posts, airfields, civilian defense organizations, and the like. These arrangements should be of extra good quality and will have to have many special features. This is our first line of defense in case of enemy attack. In addition, we should have auxiliary switching centers, and alternative communication routes around and between key cities. Every minute that can be saved by having the best possible telephone set-up may save countless lives.

"Always remember this:

"Even though you've added fifteen million telephones in the last six years, you still have a tremendous job to do. Hundreds of thousands of people are waiting for telephones. As their orders are filled, more people will apply for service. And, as you well know, nearly two million telephone users want a higher grade of service than you can provide today because of crowded lines and switchboards. Only one way to fix them up: *keep on building.*

"Of course, we do have many more telephones today than a few years ago. We have better service, too. But we also rely on the telephone a great deal more than we used to. It's a basic tool and we can't do without it. The way this country lives and works is more dependent on the telephone than it ever was before. Any failure on your part to keep up with the country's telephone needs would simply mean that more people would be affected than at any time in the past.

"So we count on you to do this job. Otherwise the whole country will suffer—and that must not be allowed to happen."

What the Country Expects of Us

THIS, in a general way, is about what the country expects of the telephone company. It is a challenge which the telephone company will meet.

The Bell System has always been counted on to take the lead in advancing communications research and development, moreover, and we have a tremendous responsibility to keep them moving ahead. This is equally true of the manufacturing techniques we have acquired and are continually improving, which are immensely valuable to the country's defense.

For instance, in World War II, Bell Telephone Laboratories * and Western Electric, our research and manufacturing organizations, designed and produced more than half of the radar equipment used by the Armed Forces. Now the same team has created improved electronic gun directors, and controls for guided missiles. Together they are operating the Sandia, New Mexico, project for the Atomic Energy Commission. Other members of the Bell System team also give a helping hand in a variety of ways. Key people are made available from time to time to assist in national defense projects, whether the need be for craftsmen, engineers, or other special skills.

Such things are important *plus* values, over and above the basic job of furnishing telephone service and making it better. The main thing to remember is that in peace or war, or in organizing and preparing for defense, the country counts on us to keep our part of the communications business always moving forward on a broad front.

What I have said so far might be summarized in this way:

The Bell System has important work to do, now and for the future. Demands upon us are heavy. The nation's needs are great. What the System accomplishes in the months and years before us is of real consequence to everybody. This is serious business—and on a big scale.

Financial Problems of the Post-War Years

A BASIC INDUSTRY like ours simply has to measure up to its full responsibilities—including those extras which always mark a truly outstanding job. It must have able people on the job. It must use good, reliable equipment, and as much of it as is really needed.

* See also "Post-War Achievements of Bell Laboratories," beginning on page 163.

Electronic controls for guided missiles are an important development, by Bell Laboratories and Western Electric, carried out for the Armed Forces

To be able to do these things, it must be in first-class shape financially.

The two outstanding telephone facts of the post-war years seem to me to be these:

First, we have been faced with the greatest demand for telephone service in history. This tremendous demand is continuing.

Second, this has occurred during a time of continually increasing costs. Wages, supplies—all the day-to-day expenses—have kept going up. Telephone wage rates, for instance, have more than doubled since 1940. The investment needed for each new telephone has steadily increased. That was inevitable when wages and the prices of copper and lead and rubber and other heavily used materials doubled and tripled. Taxes, too, have been increasing sharply. In short, it has cost more and more to put each telephone in, and also more and more to operate it.

To meet the demand and install the telephones, we have obtained well over four billion dollars from investors. And we raised this money at precisely the time when both the investment and operating costs were rising. Rate increases have not been sufficient to offset these higher costs, so that earnings have been inadequate. These low earnings, in turn, have meant that in obtaining new capital, we have not been able to get as much of it as we should through stock ownership. Under these circumstances, the greater part of all the new capital needed had to be borrowed. As a result, borrowed money today represents nearly half of all the System's capital, compared with less than a third at the end of 1945.

THE BELL SYSTEM has behind it a 75-year record of financial integrity. Such a record bolsters the confidence of investors that our historic financial strength will be maintained in spite of temporarily inadequate earnings. I

Providing adequate telephone facilities for military installations is a prime obligation upon the Bell System

Providing air raid warning systems throughout the country is a big undertaking

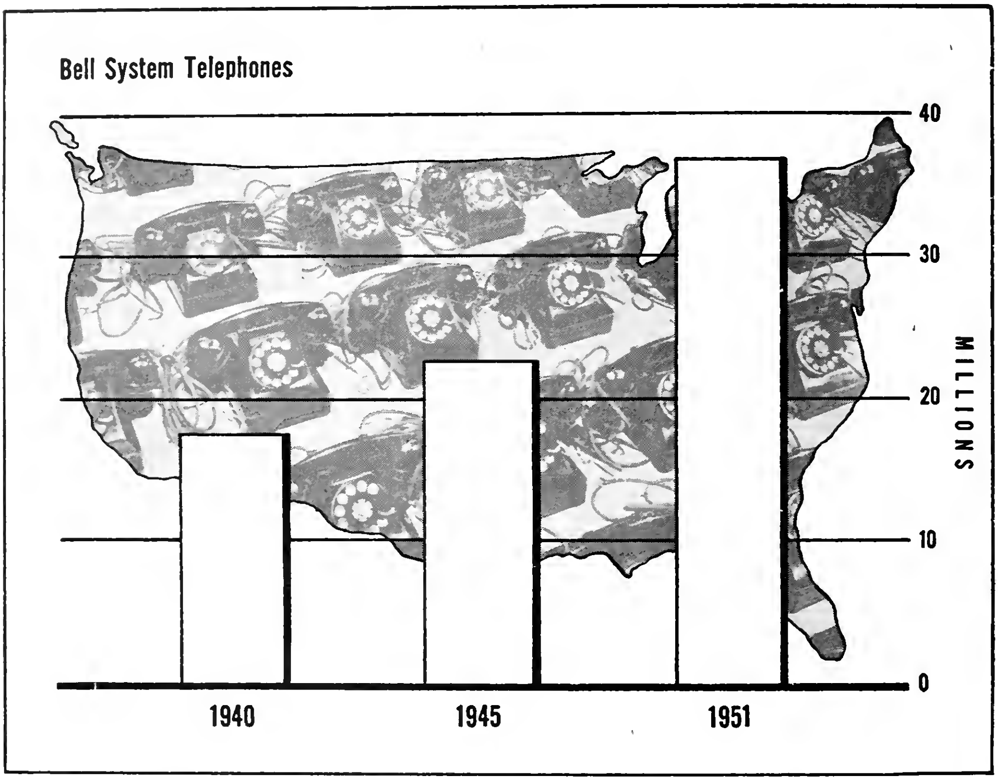
want to repeat, however, that in 1945, when we came to the end of the war and stood on the threshold of this great post-war expansion, the System's debt was less than one-third of total capital. That was what made it possible for the System to obtain the billions it needed in the next few years. That was what enabled us to borrow huge sums on reasonable terms; because our credit was first-rate, we could prudently increase our "mortgage" for the time being to meet the situation.

Now we are looking to the future—a future loaded with important and necessary work, calling for additional heavy construction and the investment of still more capital. We shall need more money from investors, in large amounts. We have already increased our debt. Experience has proved that the foundation of our ability to serve the public well is to keep our credit good. What, then, should be our future course?

We Must Obtain Stock Money and Pay Off Debt

To me, it is clear as sunlight that we need to attract investment by hundreds of thousands of people in A. T. & T. stock. We must plan to restrict our borrowing, to keep paying off on our mortgage. We need to get more

Postwar Growth Has Created Tremendous Bell System Need for More Capital



The number of Bell System telephones has more than doubled since 1940

people to buy into the business—or to increase their present ownership—instead of merely lending us their money. The decision of an investor to buy stock in a particular company is made in consideration of how much that company's earnings, dividends, and general prospects appeal to him when compared with other companies. In our case, it isn't a matter of making our situation and prospects attractive merely to a few investors. We must appeal to hundreds of thousands of new investors, as well as to the million stockholders we already have. Why so many? Because we need such tremendous sums of money to build new facilities and expand and improve the service.

These facts simply bring out that our "investor appeal," if I may call it that, must be excellent. But in recent years our income has not been adequate. Earnings on our capital have been low at a time when the earnings of the other industries with which we compete for investors' dollars have been high.

While other businesses have been hit by inflation as we have, they have generally been able to offset their increased costs by prompt repricing of their products. This is in sharp contrast with the telephone business, for we are under public regulation—and the process of regulation takes time. Nevertheless, the basic fact remains that the remedy for us is the same as for any enterprise that finds its costs going up. There is no alternative to getting higher revenues, and that means higher telephone rates.

Increased Telephone Rates Are Reasonable

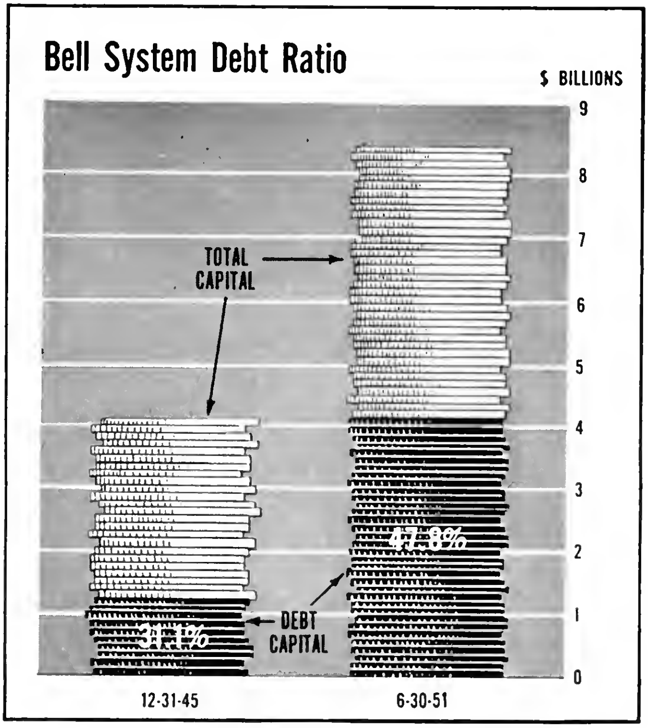
It is clear that the rate programs of the Bell Companies are of real importance and significance to the country. Adequate rates bring good earnings, good earnings improve credit and attract capital, capital builds facilities to provide needed service. Adequate rates permit us to attract and hold competent people.

It is clear, too, that by any standard you can find, the Bell System rate program is reasonable.

For instance, Bell System intra-state rates have increased, on the average, only 24 per cent since 1940. If we include all the rate requests that are now under consideration, the average increase would still come to only about 40 per cent.

The official cost-of-living index * is now up more than 85 per cent over 1940. Food, clothing, housefurnishings, and so on—as you know from personal experience—have risen even more. The chart on page 161 brings out in a startling way how little telephone prices have risen compared with the prices of most other things.

Other standards of comparison also help to show how reasonable the telephone rate program is. For instance, because telephone wage rates have more than doubled in the last ten years, the operating expenses of the Bell Telephone Companies are higher by about $900,000,000 a year. This amount alone is nearly twice as much as all the increases that have been made in telephone rates.



The ratio of debt in the Bell System's capital structure, which was less than a third at the end of the war, is now nearly half

*Consumers' Price Index, U. S. Dept. of Labor.

Look at it from another angle: this time the angle of earnings. In 1940 the 30 large industrial companies included in the Dow-Jones Market Average earned an average of 9.7 per cent on their capital. The Bell System in the same year earned 7 per cent. Ten years later, in 1950, these 30 companies averaged 14.4 per cent earnings and the Bell System only 6 per cent. Please bear in mind that those 6 per cent earnings are the earnings of the enterprise which needs more capital from investors than any other company, and which must compete for investors' dollars with other well-managed companies that are currently earning more than twice as much.

Here is another striking fact. The average income per household—after taxes—was more than twice as much in 1950 as in 1940.* Compare that with the modest over-all increase in telephone rates. Telephone service is one of the greatest bargains in the household budget, and an even greater bargain than it was ten years ago.

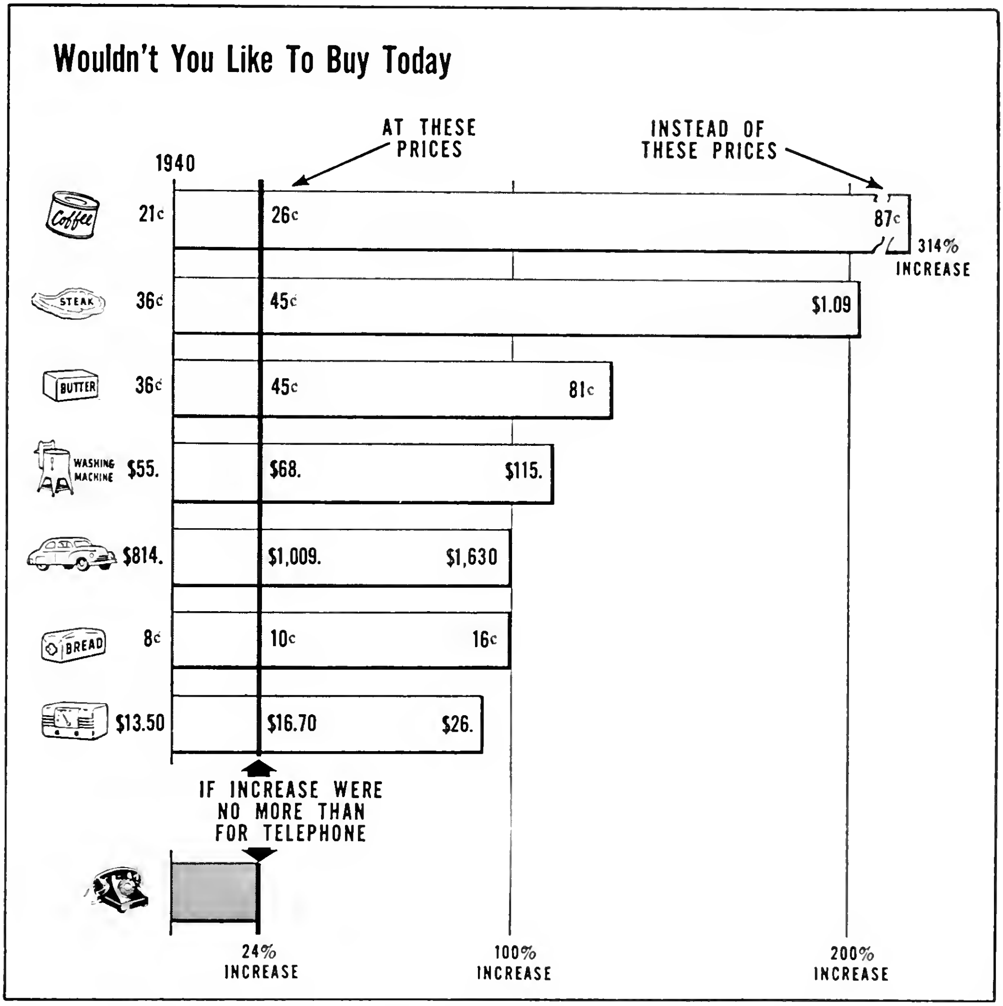
Telephone Progress Rests on Financial Good Health

Some readers may wonder why all the telephone rate increases that have been asked for can come to so much less than the general rise in prices and incomes.

The fact is that all during this time of inflation, great advances have been made in the techniques and methods of providing telephone service. These advances have offset some part of the rise in costs. They are a big reason why our rate increase program can be so reasonable—and why the cost to the telephone user comes to only a few cents a day. Actually, all the increases that have been made in telephone rates, plus those still needed to assure the Bell System's continuing finan-

Copper wire is only one of many items of telephone plant which have more than doubled in cost

* Federal Reserve System—Average Disposable Income.



The cost of telephone service is a much smaller part of the average household budget than it used to be. This chart shows what today's prices of various commodities would be if the increase were no more than for the telephone

cial strength, average out to hardly more than the cost of your daily newspaper.

I think you will agree that these telephone pennies buy a great deal. Just run over in your mind what the telephone means from day to day. Doing errands. Calling the doctor. Getting your business done. Linking you with friends and loved ones. A few additional cents a day buy the assurance that all these things will continue to be done for you, and done well.

They buy even more. For they assure continuance of the same progress that has given this country the best telephone service in the world, and that even now is reaching out to new horizons. Already, local calling areas are widening. Long distance operators are dialing millions of calls di-

Hundreds of thousands of Americans still look to the Bell System to put telephones into their homes

rectly to telephones in far distant places—completing calls over hundreds or thousands of miles within 30 seconds, sometimes even less. And there is much more to come.

You know the telephone as your servant in emergency. It is the nation's servant in emergency too. Nothing is more important to the nation's defense than a strong, sound telephone system. This strength, this soundness, rest on the rock of financial good health.

IF WE SUM UP, then, we see that

—all the rate increases granted and asked for are less than one-half the general rise in the cost of living

—telephone earnings are low when you compare them with the earnings of a great many other companies with which we must compete for capital

—telephone bills are a much smaller part of the average household budget than they used to be

—telephone rate increases have been only a little more than half of telephone wage increases alone, to say nothing of other rises in costs

—a few cents a day is a small price to assure the continuing capacity of the telephone to serve the people well.

THERE YOU HAVE IT. It's a straightforward story—a simple story—a story that anyone can understand. The fact that our requirements are so reasonable gives us full confidence that the public will support this rate increase program, which will insure that our country will continue to have the best telephone service in the world.

The Bell System's Research Organization Has Completed More Important Developments in the Past Six Years than In Any Like Period in Its History

Post-War Achievements of Bell Laboratories: I

Oliver E. Buckley

This is the first of two articles by the Chairman of the Board of the Laboratories. The second will appear in the Winter issue. EDITOR

THE RECENT WAR left in its wake a pent-up demand for service and a new set of world conditions under which that service must be furnished. It also speeded up many technological developments for which the ground work had been laid in the preceding decade. This combination of new needs to be satisfied and new art to meet them set the stage for an impressive output of new communication systems.

This amounts to saying that the period since the war has been one of golden opportunity for technical progress. What follows is a story of how this opportunity was seized and what came out of it.

The record is impressive. A larger number of important developments were completed than in any other six years of Bell Laboratories' history. The fact that the season was right for such a crop need not lessen our pride in it; for institutions, like men, only make the most of opportunities when they have prepared themselves to do so. The knowledge of materials, of electronics, of circuits and waves which was built into these new systems was the product of years of persistent study and experiment. In the last analysis, therefore, what has been accomplished since the war must be credited to the long-standing Bell System program of communication research.

A single example will serve to illustrate what I have in mind. Waveguides—that is, hollow pipes for carrying electric waves—have found their first peacetime use for communication purposes in radio relay. The study of waveguides at the Laboratories, however, goes back nearly 20 years to a time when an adequate means of generating microwaves did not exist, and when it would have taken a pipe hundreds of feet in diameter to transmit any signal which was being used commercially for communication.

The things we do at the Laboratories today always have such roots in the past. In the same way, the roots for our future accomplishments must already be growing.

In this article it is possible to mention only a few of the things accomplished, and these briefly. The smaller day-to-day jobs upon which we spend a large part of our time, and which play such an important role in keeping the System constantly modern and efficient, will not be mentioned at all. Even some of the more newsworthy developments have been omitted: among them telephone circuits over power lines in rural areas, packaged dial offices for use in small communities, private communication facilities for the civil airways authorities, modern equipment for switching telegraph circuits, and classroom hook-ups for shut-in school children. And the scientific research upon which our future hopes depend will scarcely be touched upon.

Even with these omissions, a fair impression should emerge as to the magnitude and variety of the work upon which the Laboratories has been engaged, and the measure of success it has attained.

A New Telephone

THE TELEPHONE which is now most familiar to the public was first manufactured in 1937. It was then the best telephone in the world, and has retained that position of leadership for many years. However, research through the years has brought new materials, new knowledge, and new manufacturing processes. A new telephone has been designed to take advantage of these advances, and to keep abreast of changes in public taste.

It is different in substantially every detail.

In appearance, it conforms to modern ideas of pleasing design. The handset is lighter, and its shape is better adapted to the average customer's head. The letters are placed outside the dial, where they are visible when the finger wheel is in motion. The bell has a more pleasing sound, and its loudness is adjustable. All these are features which add to the customer's convenience.

PERFORMANCE has also been greatly improved.

The transmitter delivers three times as much electrical energy for a given sound input, and the receiver recovers three times as much sound from the electrical signal which it receives. This gives a better volume of speech to subscribers far away from the central office, and permits the use of finer wire on the lines of those who are nearer. An ingenious device is provided to adjust the loudness automatically to the optimum level regardless of the distance to the central office. The naturalness of the speech is improved by reproducing more overtones than before. Loud clicks are automatically suppressed. The dial operates more uniformly and can be used at greater distances from the central office.

Many features have been introduced to simplify manufacture, reduce the need for maintenance, and make installation easier.

For example, all components — including the dial—are mounted so as to be readily accessible when the cover is removed. The set is so designed that most variations in service requirements can be met by moving a wire from one terminal to another, or by some equally simple procedure which the installer can carry out on the job, instead of providing several kinds of sets differing in minor details to meet different needs. This not only concentrates manufacture on a smaller number of types; it also makes it easier for the Operating Companies of the Bell System to maintain a stock of telephones suited to their needs.

The latest telephone instrument designed for the Bell System is modern in appearance and has improved transmission characteristics

Carrier Systems for Short Wire Circuits

CARRIER SYSTEMS provide the means by which several conversations may take place simultaneously over the same pair of wires. They have played an important role in bringing the cost of telephone service over long distances down to its present low level. They are used on open wire, on cable, and on radio.*

In the past, it has not been economical to use them on short wire circuits. The reason is that carrier systems require special equipment at the ends of the line and at intervals along it, and on the shorter lines this equipment costs more than extra pairs of wires. The break-even point, in the case of cable circuits, has until recently been at 75 to 100 miles.

There are, however, several respects in which short wire circuits place less severe requirements on the carrier equipment than long ones, so that a system can be made somewhat

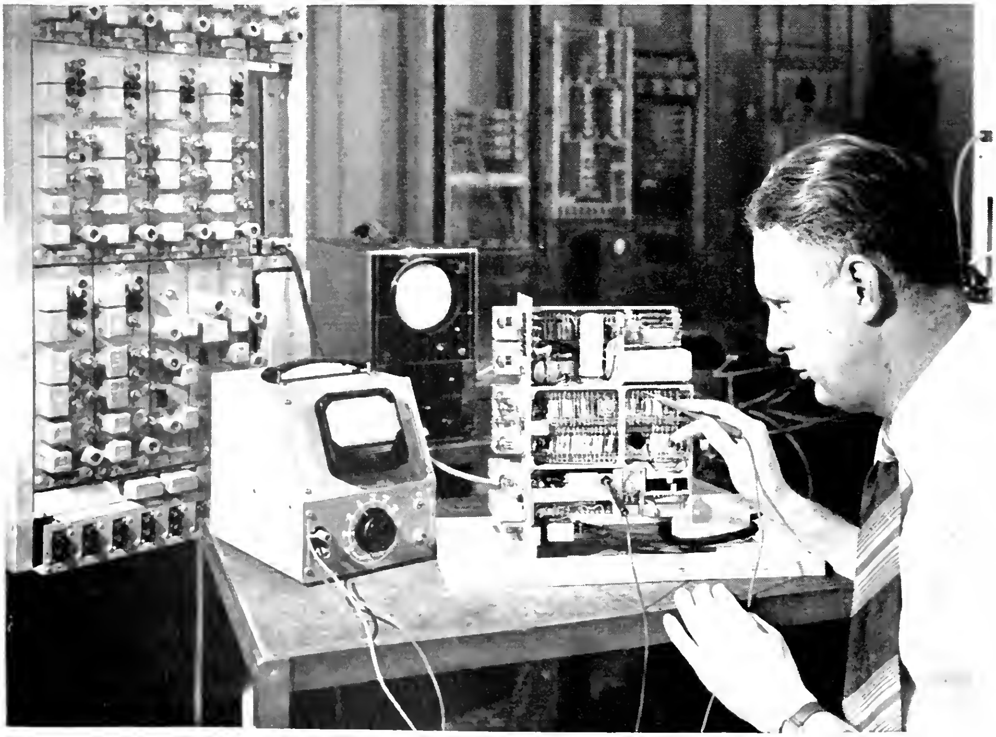
* See "Carrier Is King," MAGAZINE, Winter 1949–50.

less costly by designing it *only* for short-haul use.

By taking advantage of these relaxed requirements, and by exploiting the possibilities of new materials and new ideas of design, a system has been developed which costs less than extra cable pairs at distances as short as 15 or 20 miles. It will not replace the older systems on very long routes, but it fully meets Bell System standards of transmission on circuits up to 200 miles in length. These standards permit three or four such circuits to be connected together to provide a conversation path.

The system has many novel features. A device called a compandor confines the speech currents on the lines within narrower limits than the sounds which produce them, but at the distant end restores the full range of sound volumes. The currents which convey the stronger sounds thus cause less interference in adjacent circuits, and the weaker sounds are less affected by circuit noise. New circuit components—especially some which have resulted from the Laboratories' research on semi-conductors—are used in many places where vacuum tubes would otherwise be required, with a consequent reduction in size and cost, and also in the amount of power used.

Special care and much ingenuity have been exercised to keep the equipment compact. Maintenance has been made simpler by mounting whole circuits as plug-in units, so that when a



A recently developed carrier telephone system, compact and efficient, brings the advantages of carrier telephony to telephone circuits used over relatively short distances unit needs attention it can be replaced by a spare as easily as vacuum tubes are interchanged. The compactness of the apparatus has facilitated this type of mounting. Although low cost has been a major consideration, it has not been achieved by sacrificing quality or adaptability.

The system provides 12 two-way circuits on two pairs of wires, and includes every feature which is needed to handle calls dialed by either customers or operators. Moreover, both pairs can be in the same cable, which is not usually the case with the older systems.

Coaxial cable currently being installed contains eight coaxial pipes, together with their supervisory wire circuits, and can carry many hundreds of telephone conversations or several television programs

Thus it will be possible to provide for the rapidly increasing volume of toll traffic by increasing the capacity of cables already in place, instead of adding new ones. This will be of special value in conserving copper during the present emergency.

Broad Band Coaxial Systems

A COAXIAL LINE is a small pipe with a wire running through the middle. Telephone currents travel along such conductors in essentially the same way as along a more conventional pair of wires. But because one conductor (in the form of a pipe) completely surrounds the other conductor (in the form of a wire), the currents are shielded against electrical disturbances from without that would affect transmission over ordinary wires, especially at very high frequencies.

The Laboratories began to investigate the properties of coaxial lines many years ago, as a part of its established policy of exploring new things. Theoretical study indicated that very broad bands of frequencies could be transmitted over them and used to provide large groups of telephone channels at low cost. The development of a system to transmit a band of frequencies about 3,000,000 cycles wide was therefore undertaken, and also of terminal equipment to subdivide the band into as many as 480 telephone channels.

During the late '30s, the Laboratories conducted a successful field trial of this system over a circuit between New York and Philadelphia; and, just as the war began, this circuit, and another that had been built between Minneapolis and Stevens Point, Wisconsin, were put into commercial service. At this point the program was interrupted by the war.

When the war ended, development was resumed, and has proceeded along two lines.

In the first place, the pre-war system has been modified and improved. Some changes were made to correct weaknesses in the original design; others were necessary to adapt it to television; 120 more telephone channels were added. These changes, most of which have now been incorporated in substantially all of the coaxial in service, make it possible to carry as many as 600 conversations over a pair of pipes, one for each direction, or to send a television program to any required distance over a single pipe.

In the second place, development of an entirely new system was begun, and has already made substantial progress. This system, when completed, will transmit a band of frequencies more than twice as wide as the present one. Such a system could be used in many ways. It could carry as many as 1,800 conversations, or it could provide a medium for transmitting television with more detail than at present, if in the future this should become necessary for some such purpose as the distribution to theaters; or it could be put to other uses.

Both systems operate over the same kind of pipes, and the new one is being so arranged that an existing system can be converted by changing the repeaters and inserting others midway between them. Such conversion will be economically feasible, since the cost of repeaters is small in comparison with that of the pipes.

The repeaters perform the same functions in these systems as in others: they correct the changes in shape which occur as the signals travel along the pipes, and restore them to their original strength. However, because of the broad band of frequencies that must be handled, this must be done more frequently and with greater precision. For the most part, repeaters are at unattended locations, in manholes or small outdoor huts, and great care is taken to avoid interruption of service.

For added safety, a spare pipe is usually held in readiness, and at suitable intervals along the line the repeaters are arranged to transfer the load instantly from the working line to the spare if serious trouble develops on any section of the line. The personnel at attended stations receive alarms when difficulties arise anywhere on the section of the line which is in their care, together with exact information as to the nature of many of them. Means are also provided for transferring the load to the spare conductor by remote control, adjusting the power level, or carrying out many other necessary operations.

There are now over 50,000 miles of coaxial pipes in the Bell System

Amplifiers for the Key West–Havana submarine telephone cable are built in such form that they can be enclosed in slightly enlarged sections of the cable itself. In this picture a Laboratories engineer and two assistants are removing a finished amplifier from the assembly fixture

plant. They represent an important addition to the nation's facilities for telephone and television service, and their potential contribution, through conversion to the new system which is under development, will be even greater.

Deep-Sea Amplifiers in a Submarine Cable

THE LAST SPLICE in new twin cables between Key West and Havana was made in April 1950, following a development program begun about 20 years ago, and established another milestone in communication.*

The cables are about 140 miles long. Each is equipped with repeaters at 40-mile intervals, and is used for transmission in one direction only. Together they provide 24 high grade two-way telephone circuits.

This cable had to be manufactured to much more precise dimensions than those built previously, in order not to affect adversely the repeater performance. This required special machinery, including "electric eye" control of the insulation diameter.

It is the repeaters, however, which represent the greatest break with tradition. They are different in almost every respect from anything seen heretofore. They use specially designed electron tubes which, we have reason to believe, will last for 20

* See "New Voiceways Under the Gulf Stream," MAGAZINE, Summer 1950.

years at least. These circuit elements are housed in a flexible tube about seven feet long and only slightly larger than the cable itself.

The design of such a housing, flexible enough to pass through the cable-laying machinery and strong enough to protect the delicate apparatus within it at depths as great as two miles, where the water pressure amounts to two tons per square inch, and tight enough to keep water from seeping in even under these enormous pressures, was a major problem in mechanical design.

Power for operating the repeaters is supplied over the cable conductors from the shore.

After a period of careful testing, the twin cables were opened to regular commercial service in the latter part of June, 1950. All channels met their test requirements satisfactorily and the performance of the system has been wholly up to expectations.

Radio Relay Systems

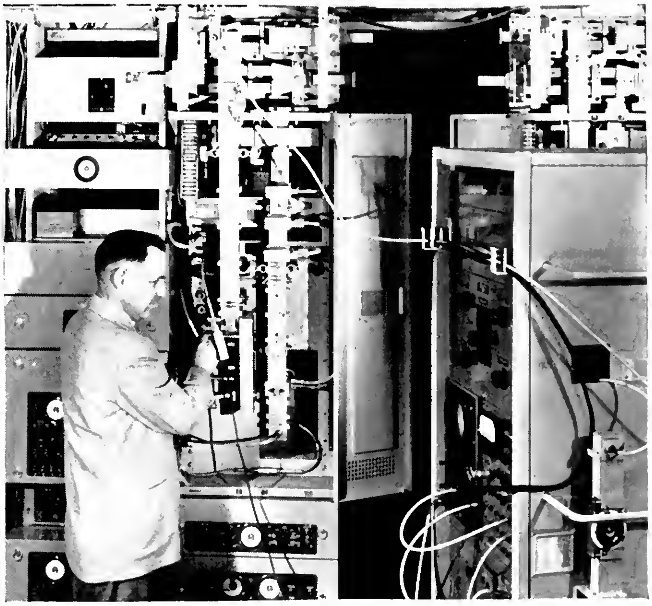
Since August 17 of this year, radio relay, the newest method of telephone transmission, has linked the Atlantic and Pacific coasts.* Used first to carry telephone conversations, this transcontinental radio relay system began transmitting television images last September; for the very broad frequency band which is divided into many voice circuits can also be used to transmit television. The same terminal equipment which is used with coaxial systems is being used for this purpose.

Radio relay is characterized by the use of radio waves so short that they possess many of the properties of light. Such waves can be focussed into narrow beams, much as a searchlight focusses light, so that a greater proportion of the energy sent out reaches its desired destination, and very little goes to places outside the beam where it might interfere with other radio systems. But, like light, such beams require an unobstructed path. Hence, the message is sent through a succession of relay points, spaced 25 to 30 miles apart and so located as to have unobstructed paths between them. At each of these points it is amplified, and is beamed out again toward the next relay point.

The advantages which would accrue from a radio system which passed the message along from repeater to repeater—just as is done in line telephony—were recognized many years ago. It was also understood that they could best be exploited by using very short waves. But vacuum tubes which would amplify such short waves, antennas to focus them in narrow beams, and circuit components to perform many other necessary functions were all lacking.

Many of the necessary circuit components became available in the late 1930s, largely as a result of a fundamental study by the Laboratories of the propagation of radio waves through hollow pipes. This study also led somewhat later to the invention of structures which focus radio waves exactly as glass lenses focus light, thus making it possible to design very efficient antennas. With these tools to work with, the development of a commercial system became possible. The first system was demonstrated on November 13, 1947, between New York and Boston, and

* See pages 175–187.



An engineer adjusts microwave radio relay equipment

was studied intensively until it went into commercial service on May 1, 1948.

While this New York–Boston system was under study, a more advanced design was worked out; and it has been used in all subsequent installations. It incorporates many refinements. Some of these grew out of experience with the Boston system. Some are products of research which became available while the Boston tests were in progress. Among the latter, a better antenna and a better vacuum tube * were especially important.

Linking New York and San Francisco are more than 100 relay stations. At each of these are two pairs of antennas, one pair pointed toward the next station to the east, and one toward the next station to the west. One antenna of each pair is used to receive incoming waves, the other to send waves forward. Each antenna, however, is capable of receiving or sending six different broad band channels simultaneously. A fully equipped route, therefore, could accommodate thousands of conversations simultaneously; or it could carry six television programs in each direction.

Only a few of these relay stations have attendants on duty. Special care must therefore be taken to assure service reliability. There are standby power plants to take over if commercial power fails. There are also special circuits over which alarms are sounded at some place, such as a nearby telephone office, where a maintenance man is on duty at all times, and over which coded signals are sent to him to tell the character of the trouble which has developed.

One of the six possible channels is to be held as a standby, ready to take over if serious trouble occurs. At present, the load must be switched to this channel manually at some relay point where attendants are on duty; but arrangements are now being developed to make the substitution automatic, even at unattended points.

As a complement to this long-haul design, a simpler one has also been worked out for use over short distances. It serves two purposes: to pick up television programs and carry them to the nearest point on a backbone route; or to provide short-haul

* See "Spanning the Continent by Radio Relay," MAGAZINE, Winter 1950–51.

extensions from backbone television routes to nearby cities.

By the end of this year, about 25,000 broad band channel miles of radio relay will have taken its place alongside of the 50,000 miles of coaxial pipes that are now in place. Together, they will increase substantially the telephone facilitities along the nation's backbone routes, and will go far toward a nation-wide distribution system for television programs.

The two systems—coaxial and radio relay—fill similar needs, and to a large extent can be used interchangeably. This was illustrated recently when a coaxial line was cut in two by a farmer's plough, and its load was transferred to the standby channel of a nearby radio relay, while repairs were made. Both systems, however, have their special points of excellence, and also their peculiar hazards. Radio could not be interrupted by a plough; but, as everyone knows who has listened to short-wave programs from abroad, atmospheric conditions cause the signal strength to fluctuate, occasionally fading almost to the point of extinction.

Of course, over the short radio relay jumps, the fading is not nearly so bad, and the system is designed to compensate for it over very wide limits. To determine how much fading should be expected, Laboratories' engineers, with the assistance of the Operating Companies, spent several years collecting data in many parts of the country, at various seasons,

An attendant secures a telephone connection for a passenger on a train in motion and at various times of the day. From these, and from the extensive records which have been kept at some of our own locations for many years, the behavior of the proposed system could be predicted. The performance of the system to date has been in line with these forecasts, and generally satisfactory.

Other Developments in Radio

SEVERAL OTHER important radio developments have been completed since the war.

One is a new transmitter and receiver for overseas use. It is a successor to a design which has been in satisfactory operation for more than 15 years. The new transmitter will radiate twice as much power as its predecessor, and will carry four telephone conversations simultaneously, whereas the capacity of the other was limited to three. Both the transmitter and receiver occupy much less space than formerly. The transmitter is equipped with pushbutton tuning for all of its working frequencies, whereas the older equipment had to be tuned manually; arrangements are also provided for tuning it by remote control if desired.

Radio equipment was also designed to enable persons in automobiles or on moving trains to call any telephone that can be reached through other Bell System facilities and, conversely, to permit a particular automobile or a particular train to be called when wanted. This service has been so successful that the frequencies allotted for the purpose by the Federal Communications Commission are already overcrowded and additional allocations are urgently needed.

The equipment developed for these purposes is finding other uses. It is already providing trunk circuits in some special situations where open wire or cable would be difficult to construct. Such radio trunk circuits have also been installed to supplement and protect open-wire circuits on some routes which are subject to heavy sleet conditions.

Who's Who & What's What

(*Continued from page 139*)

used throughout the Bell System. He started with the Long Lines Department as a technical employee in St. Louis in 1927, and by 1939 had become district plant superintendent in Dallas. In 1946 he was appointed division construction coördinator in St. Louis, and later that year he became division plant superintendent. Early in 1950 he moved to New York as general plant supervisor, and later in the year was appointed Assistant to the General Manager. In this post he handled interdepartmental matters, including the coördination of defense activities affecting Long Lines operations. He transferred to his present position in February of this year.

ORIGINAL RESEARCH of the sort which RICHMOND B. WILLIAMS' article exemplifies is likely to foster pleasant contacts as well as to unearth significant facts, and he was so fortunate as to enlist both the interest and the assistance of officials of the Upstate Telephone Corporation of New York, in Johnstown, N. Y. Mr. J. E. Welles, public relations supervisor of that company, was particularly helpful; and since that is also the author's position in the Long Lines Department of the A. T. & T. Company, they obviously had a common

(*Continued on page 204*)

Trained, Equipped, and Ready

The most disastrous flood in the nation's history struck parts of the Mid-West last July. Damage was incalculable, and telephone plant and equipment—and people—suffered with the rest. The following report, given on the Telephone Hour radio program at the time, is indicative of the spirit in which telephone employees met the challenge. EDITOR

IT WAS RESTFUL in California where Juanita Bowen, an Ottawa, Kansas, telephone operator, was enjoying her vacation. But rest and relaxation were forgotten when she read about the floods back home. She knew there would be work to do. She cut short her holiday and hurried home to help.

In Salina, Kansas, an appeal was broadcast for at least five former telephone operators to come in and help handle emergency calls. Within 30 minutes, ten women had reported for duty and were on the job.

These are but two of the hundreds of stories of devotion to duty by telephone people in the Kansas-Missouri-Oklahoma floods. They are typical of the spirit of telephone people who fought to maintain service in the emergency, and who are fighting now to restore the service washed out by the angry waters.

I'd like to tell you about Henry Sparks, installer-repairman in Solomon, Kansas. Only two telephones in his town remained on dry ground. He connected them to toll lines to Abilene and Salina, and rowed the townspeople, in his rubber boat, to and from the telephones to answer emergency calls. Backbreaking work! But he also found time to direct the Red Cross in dropping bundles of food to the marooned citizens.

In Miami, Oklahoma, Andy Anderson, a former employe, did the same sort of ferrying job. There were three Topeka plant men, Joe Murrell, Gene Swanson and D. D. Proctor, who found themselves blocked from a trouble call by the raging water. They turned-to and helped the Red Cross until they were able to get back to their telephone duties. Time does not permit me to mention the names of many others. But there are scores.

From all over the Bell System, people and supplies have poured into the stricken area. One hundred and thirty-two Long Distance operators were flown into the flood area from New York, Louisville and Chicago. One thousand six hundred telephone workers from eight states are on the scene. They work beside thousands of citizens in the muddy job of mopping up. Before telephone service can be restored, thousands of connections must be cleaned and dried. Great quantities of equipment have to be replaced. In some towns, new telephone offices must be built.

No job, however, is too tough nor too mean for the skilled and willing hands of telephone people. Theirs is the great tradition of service. Whenever and wherever disaster strikes, you'll find them—trained, equipped, and ready to meet the challenge—backed up by the full resources of the Bell Telephone System.

Radio Relay—The Newest Means of Transcontinental Telephony

Thirty-six years ago, words first sped on wires from New York across this country directly to San Francisco. The East Coast and the West were united telephonically when service was opened on January 25, 1915.

Words made the same journey last August 17 *without wires,* when commercial telephone service was inaugurated over the new transcontinental micro-wave radio relay system, which utilizes 107 relay towers in covering the nearly 3,000 miles between the two cities.

Radio relay channels can be used to transmit television images as well as conversations, and the system was first used for TV program transmission on September 4, when facilities were provided temporarily, at the request of the State Department, to permit transcontinental telecasting of President Truman's opening address to the Japanese Peace Treaty Conference in San Francisco and several of the succeeding sessions. Regular coast-to-coast service in both directions was provided by the end of the month.

The new system brings to seven the number of telephone routes which cross the continent. Four consist principally of open wire, one of coaxial cable, one of twin carrier-current cables, and now one of radio relay. The seven routes spread from Montana to the Mexican border, but all are variously interconnected, and their number and variety are important factors in the country's defense program.

Radio relay has been discussed previously in this Magazine,* and is interestingly described on pages 170–173 of Dr. Buckley's contribution to this issue. The pictures on the next dozen pages, showing radio relay towers in many locations from the Atlantic to the Pacific, may stir the reader's imagination to ponder the inventing and designing, the manufacturing and installing, the engineering and testing and building which preceded the opening of this $40,000,000 telephone route to the service of the American people.

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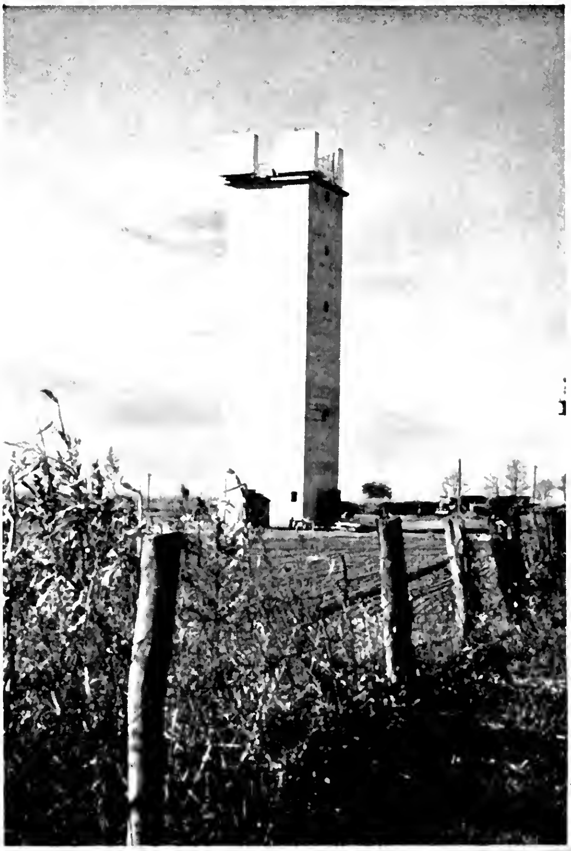
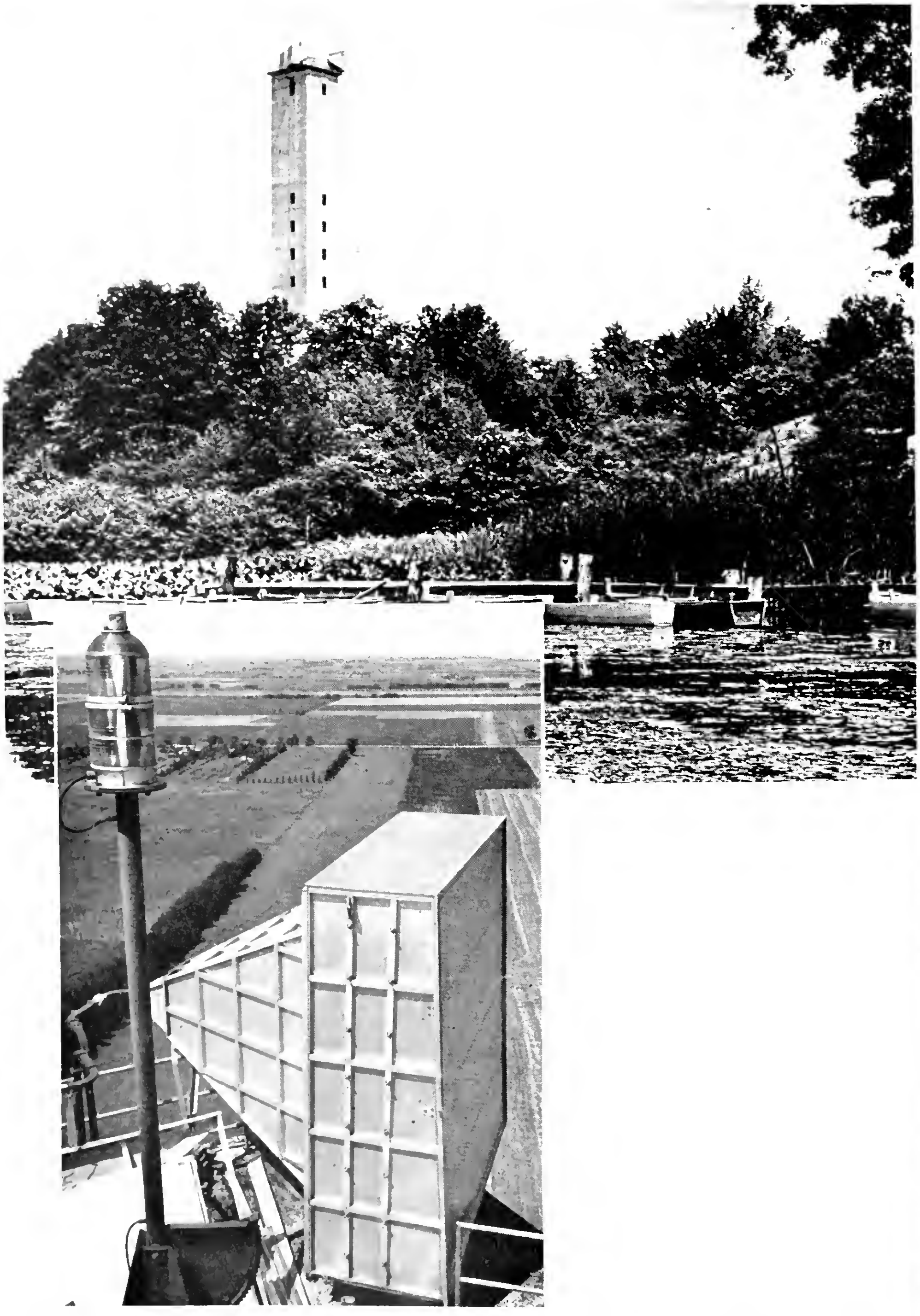
* See "Radio Relay and Other Special Buildings," Magazine, Spring, 1950, and "Spanning the Continent by Radio Relay," Magazine, Winter 1950–51.

Westward-pointing antennas atop the Long Lines headquarters building in New York mark the eastern end of the new radio relay system



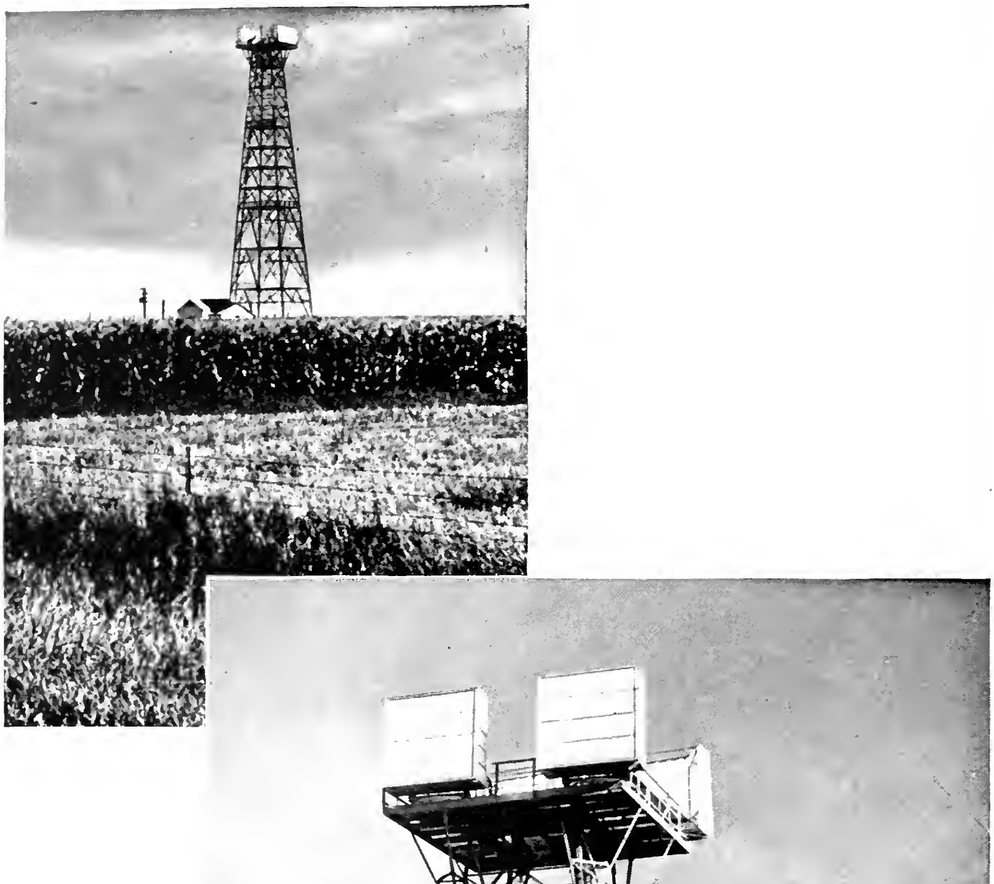
Solid amid the rich fields of the Plain People of Pennsylvania stands a radio relay tower. Of its four square metal-lens antennas, two facing East and two West, one in each direction is to transmit and the other to receive the radio signal

This tower looks out upon the enfolding ridges and the densely forested wilderness of the Allegheny Mountains



The peaceful countryside of Indiana and the cultivated plains of Illinois are spanned by the radio beams which flash from tower to tower

Tallest of them all! It's 427 feet from the ground to the top of the antennas on this tower, which stands beside the telephone building in Des Moines

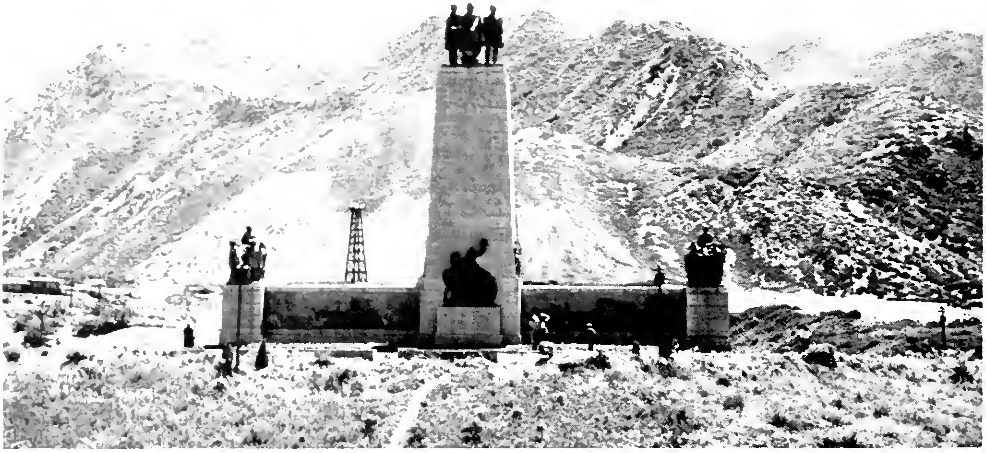


The flat and fertile farm lands of the West—of Iowa and Eastern Colorado—have new eye-catchers to see against the horizon

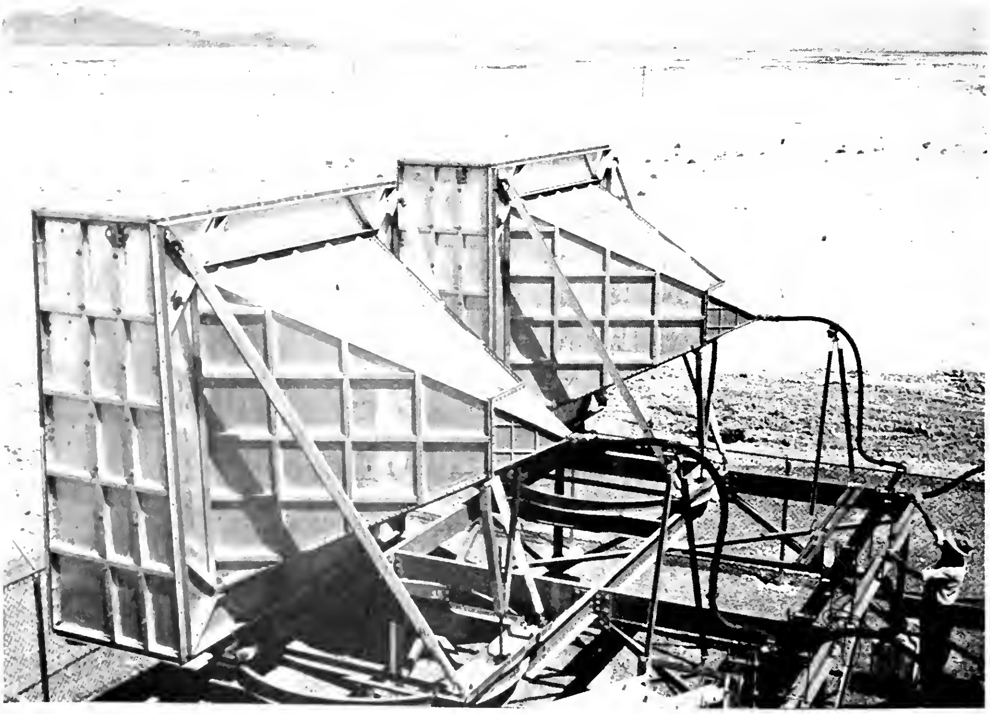
The requirements of line-of-sight transmission account for the two levels of the antennas here

Rugged terrain!

Not all towers are as readily accessible. Road building to remote and often mountainous locations was a big item of construction

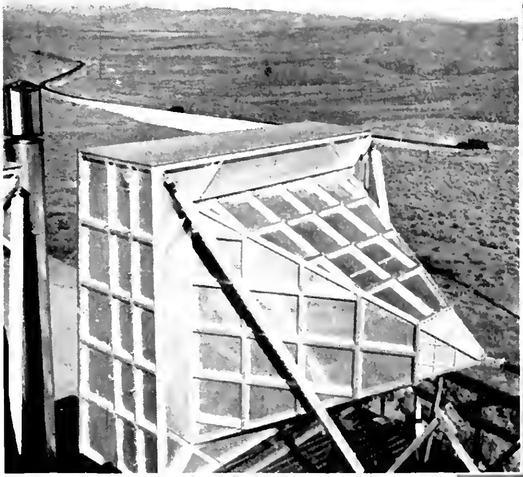


The radio relay tower appears behind the left wing of the monument. Designed by Mahonri Young, grandson of Brigham Young, this handsome feature of a barren landscape marks the spot in Salt Lake valley indicated by the Mormon leader when he declared to his home-seeking followers, on January 24, 1847, "This is the place"



The salt flats of Utah presented special problems to the transmission engineers

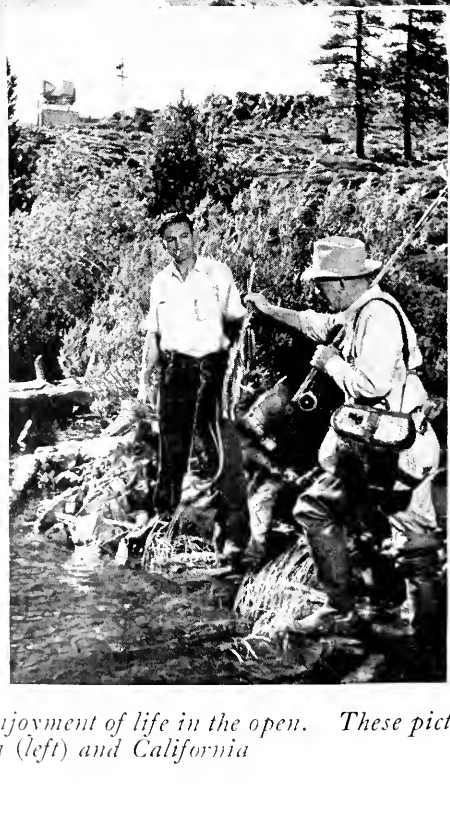
The tower itself need not be high if the hill is high enough



Across the Great Plains the road goes on and on

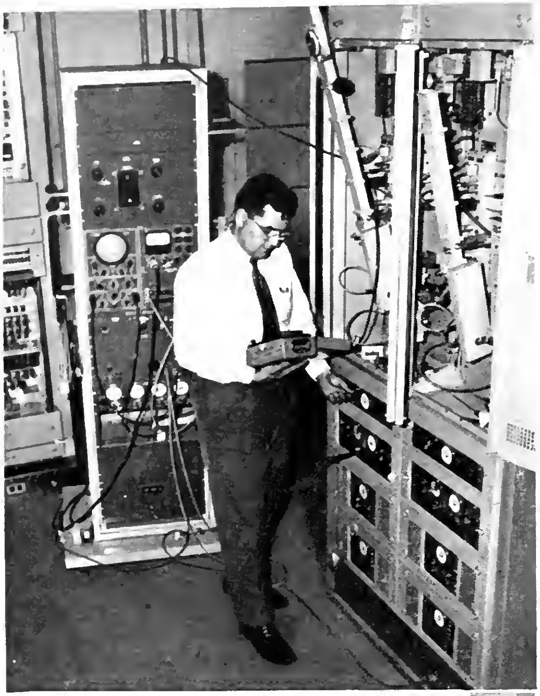
Radio relay tower and CAA airplane beacon make use of the same advantageous location

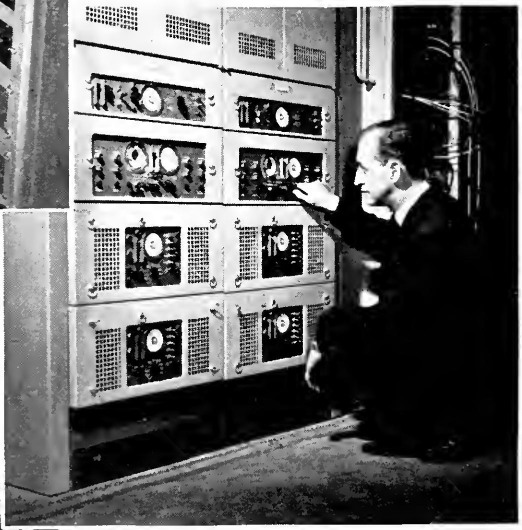
This is Mt. Rose, Nev., and the antennas are more than 10,000 feet above sea level



Radio relay towers interfere not a bit with enjoyment of life in the open. These pictures were taken in Nevada (left) and California

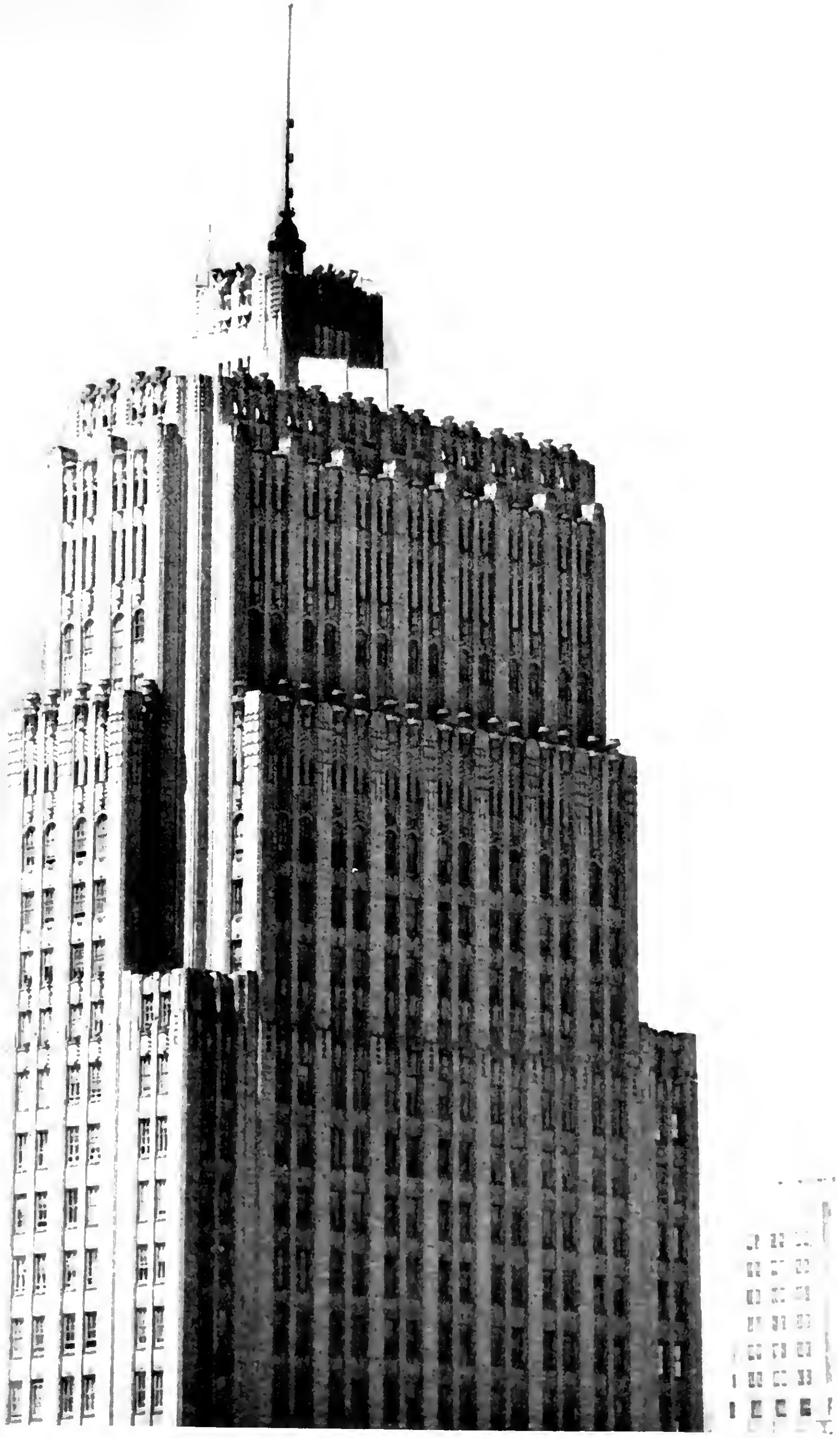
Above: The golden dome of California's Capitol at Sacramento appears in the distance.
Below: Looking westward from the radio relay tower at East Bay Hills, Cal. Across the bay lies the Golden Gate





Here is some of the equipment which speeds the radio signals on their way, with the speed of light, from tower to tower of the transcontinental system

You're looking 200 feet straight down



End of the line! Antennas on the headquarters building of the Pacific Telephone and Telegraph Company in San Francisco

The Bell System's Long-Established Policy of Conserving And Re-using Telephone Equipment Has National Significance In This Period of Scarcity of Materials

Conservation of Materials

C. C. Duncan

On Robert's Mountain in Oregon, lineman Rodney Peterson and his gang are taking down the "Old South Lead." Built in 1898—when Oregon was young and rugged—this bare copper wire line has carried long distance calls which were part of the expansion and struggles of a growing nation for over 50 years. Now it has given way to a storm-proof underground coaxial cable. While the line is old and obsolete, the hardware, crossarms, and poles that are in good condition will be re-used and will help to provide vital telephone service at other locations for the nation which still struggles and still grows. These materials will be carefully saved and re-used in their present form in the construction and maintenance of other open-wire lines.

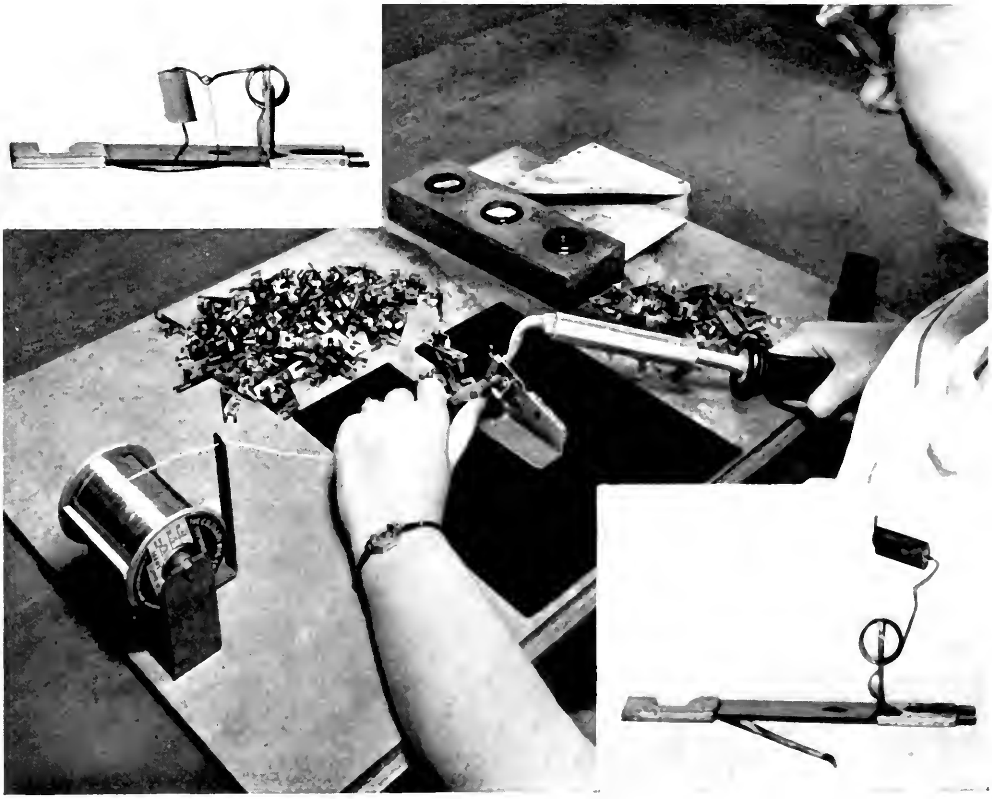
But the nation and the telephone industry are short of copper—copper for defense, and copper for telephone equipment and cables. The copper wire from the "Old South Lead" is being rushed by truck to freight cars, sent by expedited shipments across the country to Staten Island in New York Harbor, where it is smelted in the Bell System's Nassau refinery and then rushed to the Western Electric Works at Point Breeze, Md., Kearny, N. J., and Hawthorne, Ill. It is there converted into wire, parts for telephones, coaxial cables, radio relay systems, exchange cables, and equipment to meet the insatiable demand of the country for more and more telephone service.

Rodney Peterson is doing his part to supply copper and other critical materials for the needs of the nation—and the telephone industry. Many others are also doing their share—some in conservation and re-use of large amounts of material, others of small. Regardless of how small the individual amount is, the cumulative effect of the savings of all of the people in the Bell System is tremendous.

Let's take a look at a few of these people.

In the Western Electric repair shop in the distributing house at Indianapolis, Marjorie Grimes carefully puts a thin piece of low-meltingpoint wire in a blown "grasshopper" fuse to replace its burnt-out fusible link. Millions of these fuses are used in central offices to protect telephone equipment against damage and fire from abnormal electrical currents. They consist of a small piece of fusible wire and a spring mechanism which sounds an alarm and gives a visual indication when the fuse operates. The fusible wire is the only part of the fuse that was used up when it operated. By replacing this tiny piece of wire, she saves the materials and work of making an entirely new fuse.

In the Glenville exchange in Cleveland, Ken Carlson is coiling up short lengths of re-usable insulated frame wire. Miles of wire are used in the distributing frame in his large central office to connect the cable pairs and the central office equipment together. Additional subscribers, number changes, subscriber moves, and cable and equipment rearrangements require these wires on the distributing frame to be connected to different terminals. Often the old wire is too short to reach and has to be replaced with a longer piece. These short lengths are carefully saved and used over again, either in the same office or in smaller neighboring offices.



Skilled hands now repair "grasshopper" fuses. A blown fuse, at lower right, is shown restored to usefulness at upper left

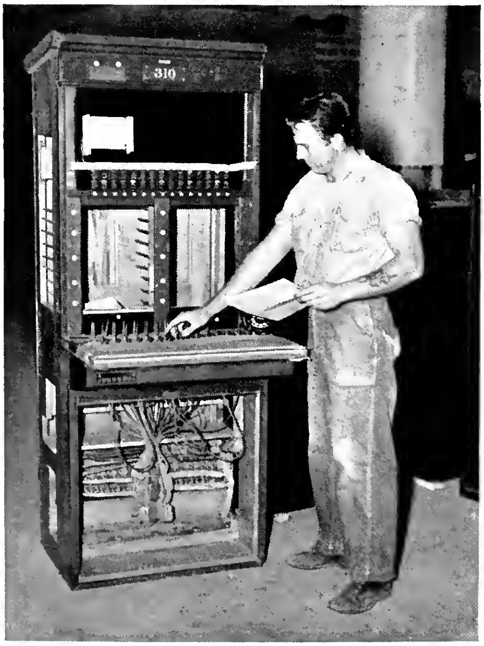
These short lengths of distributing-frame wire are saved for re-use

THE MOTOR VEHICLE SUPERVISOR at Detroit is putting a new driver through a series of demonstrations to show him, by actual measurement, the difference in amount of gasoline used over a nine-mile course when proper driving methods are used. The 55,000 cars in the Bell System use 170,000 gallons of gasoline daily, and a little saved by each car adds up to a lot of gasoline conservation.

A NEW SECTION of switchboard is needed for Curwensville, Pa. Before ordering it from the factory, a check is made in the central records file in New York, where a record is kept of the surplus equipment throughout the Bell System. This check shows that a surplus switchboard section of the type needed is available at Oceanside, Cal. While it was not the proper type of board for Oceanside, it had been used there as a temporary expedient to take care of peak loads at the Camp Pendleton Marine Base during World War II, and had subsequently been replaced. Since it can no longer be used at Oceanside, it is sent to Curwensville, thereby saving the materials and work required to build a new section of switchboard.

The Central Records Plan for disposal of surplus supplies, equipment, tools, and motor vehicles among Bell System Companies has been in operation almost ten years. During this period, several million dollars' worth of materials has changed hands. The plan enables the Associated Companies to obtain items which they require and to dispose of surplus among themselves.

The Companies report their surpluses periodically to the Western



This switchboard section journeyed nearly across the country to render service again

Electric Company, which acts as an intermediary to bring them together, although the actual purchase and sale is consummated between the telephone companies concerned. Started in 1942 as a war conservation measure, it has become a permanent Bell System procedure for conserving supplies.

A STENOGRAPHER in Springfield writes a letter on both sides of a sheet of paper; an engineer in Dallas uses the back of superseded blueprints for scratch paper; a clerk in Cincinnati is careful to run off on the mimeograph machine just the requested number of copies of a report; a house serviceman in New York collects waste paper for recovery, and an installer in Providence returns an empty cardboard carton to the warehouse for further use. All are easing the nation's paper shortage.

AN INSTALLER in St. Louis removes a telephone set. It has been in service many years and shows the effects of long usage. Nevertheless, he carefully puts it in a carton and takes it back to the garage. The supply man packs it so that it won't be damaged in shipping, and sends it to the St. Louis Western Electric repair shop. There it is thoroughly tested and inspected, worn and defective parts are replaced, the set is cleaned and refinished and, as good as new, is put back into circulation for re-installation.

That's one more set that won't have to be manufactured by the Western Electric Company's new telephone instrument factory at Indianapolis, which is striving to build up production to meet the mounting demand for more and more telephones. A few more pounds of scarce materials are saved. But when multiplied by 300,000—the number of used telephone sets that are repaired and reused each month by the Bell System—it becomes a real conservation factor.

VETERAN P.B.X. installer John Kooistra at Grand Rapids is sharpening a drill. It is a long drill—used to drill holes through beams and in difficult places. It was 18 inches long when it was issued to John, 11 years ago, and he has been using it almost daily since then. When it got dull, John sharpened it. He did it right, using tools to hold the drill at the

Used telephones, skilfully repaired, will again become part of the working telephone plant. Worn-out cords, at right, will go back to the smelter for copper salvage proper angle. Each time it was sharpened, a little of the metal was removed—so now the drill is four inches shorter than it originally was. But it's still in good condition after 11 years of use and John proudly states that he will still be using this bit when he retires this fall. He is one of many telephone men who know that "if you take care of tools properly they will give long service."

A SUPPLY MAN in Baltimore is studying the inventory and usage of supplies, to determine the least amount of supplies to be carried on trucks and in the storerooms and still have enough on hand when needed.

The 44,000 maintenance and construction trucks in the Bell System are equipped with the supplies that are needed every day by the maintenance and construction men. Installation trucks have telephone sets, wire, and all of the numerous pieces of material needed for installation of telephones. Construction trucks carry cable sleeves, solder, hardware, etc., for building telephone plant. Each truck has to have enough on hand to meet the requirements. But a little too much on each truck would add up to a large quantity when multiplied by all of the trucks in the Bell System—so the supply man is constantly reviewing the requirements to keep these stocks at a minimum.

He knows that many of the telephone supplies are made of critical materials which are needed for defense and that any reduction he can make in the stocks on hand will be reflected in reduced demands on the factories for new materials.

THE CROSS-ARM on the pole line in Colorado has been in service many years. While it is still strong and able to carry its load of wires, it has started to split from the effects of rain and sun, and the end insulator pins are loose and starting to come out. In past years this meant replacing the cross-arm with a new one—but then someone thought of pulling the split together and fastening it with a steel band. So, the section lineman is banding the cross-arm, making it last many more years, saving the time required to replace the cross-arm and transfer the wires and saving the wood that would have been required for a new arm.

Sharpening a drill he has used for 11 years

SHORT ENDS—pieces of new insulated drop wire left over in the reel, other pieces of used

Placing a metal band tightly around the end of a cross-arm postpones—perhaps for years—the need for a new arm and for transferring the wires

wire still in good condition—all good wire but too short to reach from the pole to the house. These are rubber-insulated twin copper-coated steel wires with a heavy neoprene jacket, and are not easy to splice properly. But some way had to be found to use these short pieces. So a special splicing machine was developed which securely fastens the conductors together and then by heat and pressure forms a plastic insulating covering over the completed splice. Now 3,000,000 feet of short ends of drop wire are spliced together each month in the Western Electric repair shops, saving 130,000 pounds of material in this one conservation operation.

An engineer in Philadelphia studies the exchange cable layout to get the maximum usage from existing cable pairs so as to defer installation of new cables. He has to be sure that cable pairs are available when needed for new telephone service—and also that these cable pairs are not idle for long after they are constructed. The proper balance between too much and too little cable plant is always with him, but the critical copper shortage has accentuated it now. When new telephone cables are required, he specifies the smallest gauge of wire possible for satisfactory transmission, in order to stretch the short supply of copper as far as he can. He gives thanks to the Bell Laboratories' people who developed the new "500 type" telephone set, which has the increased efficiency to enable him to "stretch" his copper into thinner conductors than he could use before.

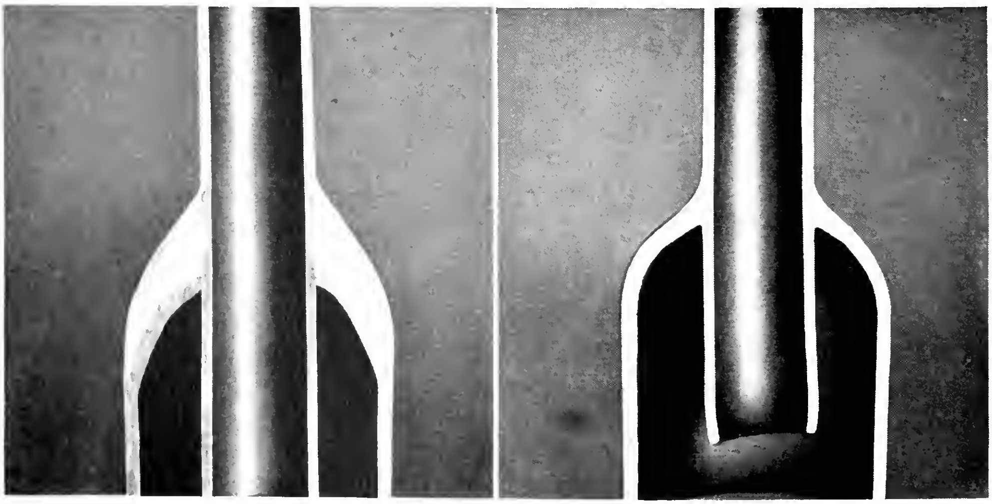
The Company car has been "loping" a bit, so when the installer brings it into the garage that evening he reports this to the garage mechanic. The mechanic loosens up the valve that is starting to stick, and the car

Splicing short pieces of drop wire together makes usable lengths—and saves tons of material into the bargain

is back to normal—thereby avoiding the replacement of a valve made of steel which is critically short.

THE SPLICER is sealing a joint in the telephone cable with hot solder. He started working for the Telephone Company in 1946, after returning from World War II, and this is the way he was taught to wipe a cable joint. It doesn't seem unusual to him, but the old-timers could tell him that it is a special type of splice, called the "Victory Joint," which helped to conserve tin to win that war.

Before then, the joints at the ends of the cable sleeves were wiped in a rounded, ball-like shape and used a lot of solder. When tin became scarce, in 1942, a new technique was developed which used only a small fillet of solder at the edge of the sleeve. It saved about 110,000 pounds of tin yearly during the war —and several times that amount after the war. Just because the war



The old fat soldered cable-sheath joint—shown in cross-section—gave way to the sleek "Victory" joint at the right—and tons of scarce metals are saved every year was over and tin again became available was no reason for dropping a good method—so the "Victory Joint" is the only kind the new splicer knows how to make—and the Bell System continues to save over 400,000 pounds of tin a year.

DURING the day, the installer in Knoxville has been saving the ends of wire, clamps, and hardware that he has removed, and dropping them into his material bag. The cable splicer in Albany has an old lead sleeve and some small pieces of cable sheath. The equipment maintenance man in Wright City has replaced three worn-out vacuum tubes. The teletypewriter repairman at El Paso has a few broken and worn parts. The mechanic in the Hawthorne factory has gathered up some brass cuttings.

All over the country, telephone people are recovering and collecting these pieces of scrap. Most of them are so little that they seem insignificant—except that they shouldn't be left to litter up the Company's or customer's premises. But these hundreds of thousands of little trickles of scrap help to make up the flood—350,000 pounds per day—that flows into the Western Electric Company's scrap recovery plant on Staten Island, the Nassau Smelting and Refining

Junked copper line wire goes into a smelter in the Western Electric Company's recovery plant, and will find its way again into the manufacture of telephone equipment

Company. In this plant, experts sort out and reclaim all of the re-usable materials in the scrap returned. It is fed into furnaces and refined into basic metals for making new telephone equipment.

It is a real help. About one-seventh of the copper used by Western Electric's factories in 1950, 35,000,000 pounds of lead and approximately 100,000 pounds of nickel and nickel alloys, came from Nassau. Added to this, almost 2,250,000 pounds of nickel and nickel alloys were recovered from cuttings and filings at the factories, and 780,000 pounds of aluminum and 41,000,000 pounds of iron and steel were pumped back into the raw material market under Nassau-established contracts with local smelters—all of which came out of the flood of scrap sent in by people all over the Bell System.

A GROUP OF ENGINEERS from the American Telephone and Telegraph Company, Western Electric Company, and Bell Laboratories are working on substitutions for nickel, which has become very scarce because of defense demands. They will solve this problem, as they have solved many others. Typical examples of annual savings already made are: 2,400,000 pounds of copper by substitution of aluminum for drop wire clamps; 23,000 pounds of tin foil in capacitors released by aluminum; 250,000 pounds of aluminum in telephone dials by substitution of steel. Many other substitutions are on their way to ease the shortages of critical metals, and to insure that the flow of equipment needed for telephone service goes on.

This is an example of the coördinated work that is being done in the Bell System to provide economical telephone service for the nation with the minimum usage of critical materials.

ALL OF THESE PEOPLE and many more throughout the Bell System are doing their part to answer the nation's vital need for conservation of scarce materials. But they didn't just start doing it when the present emergency developed. Repair and re-use of telephone equipment and salvaging materials is a normal way of life in the Bell System. While the pace quickens and the direction changes somewhat in times of shortages and national emergencies, the methods and practices have been developed over many years and are continually being followed. They are a real contribution toward reducing the demand for critical materials and manufacturing facilities and for providing good telephone service at the lowest possible cost.

The Bell System is one of the largest users of materials in the country, and it is fitting that all Bell System people should always be on their toes to conserve this material and get the maximum benefit from it—whether in peace or war.

Half a Century Ago the Telephone Bore to Vice President Theodore Roosevelt the News of His Succession to the Highest Office in the Land

TR Receives His Summons To the Presidency

Richmond B. Williams

Author and editor are indebted to Mr. Hermann Hagedorn, Secretary of the Theodore Roosevelt Memorial Association, in New York City, for his assistance in providing material used in the following article. Mr. Hagedorn, a biographer, was a friend of the late president.

THIS 75TH ANNIVERSARY YEAR of the telephone is also the 50th anniversary of the assassination of President William McKinley and the succession of Theodore Roosevelt as 26th President of the United States. There is much more than a coincidence of anniversaries to link these events, however. For the telephone, then still in an early stage of development, carried what may have been its most important messages up to that time in summoning the Vice President hurriedly to assume leadership of the nation.

For TR, as he was nicknamed, a difficult and historic week was ushered in on September 6, 1901, by a long distance telephone call.

So stated today, nothing could seem a more normal and casual occurrence. But it was not thus in 1901. Then there were only about 1,762,000 telephones in the United States,* of which more than a million belonged to the Bell System. The average number of toll connections handled in a day then was only about three-fourths as many as those transmitted at present in an hour. Moreover, if the connection was very long, an operator or two might have to come in on the line to help relay the conversation. Telephones were still rather a novelty, and obviously a long distance call on that September day just half a century ago did not relate to trivialities.

The chain of events began when the Vice President, a sportsman and robust outdoorsman, was attending the annual outing of the Vermont Fish and Game League, held on the

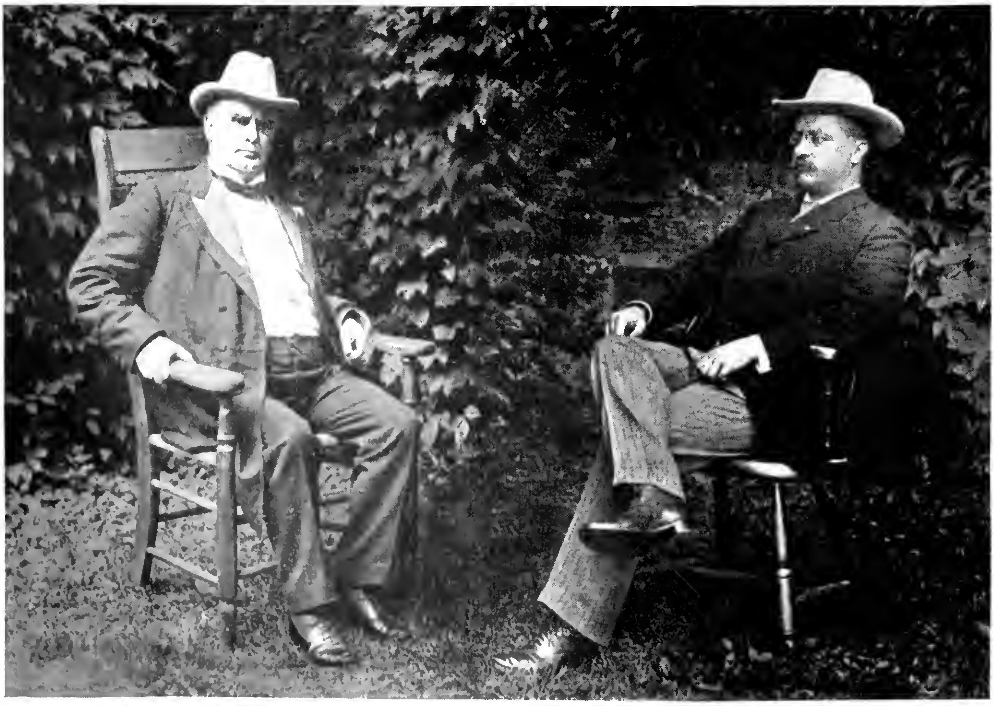
* More than 43 million today.

lawn of the residence of a former lieutenant governor of the State, at Isle la Motte in Lake Champlain. TR had made an informal talk after the meal, and the outing was over except for a general reception in his honor.

At that moment the host, Nelson W. Fisk, who had been called into his house to take a telephone call, hunted up Senator Redfield Proctor and the two men held a whispered conversation. Then Fisk drew Roosevelt into the library. Here he revealed to him that the wife of J. C. Butler, general manager of the New England Telephone Company in Burlington, some miles to the south, had called to say a story was coming in over the wires that, while opening the Pan-American Exposition in Buffalo, N. Y., President McKinley had been shot by a fanatic. Both Fisk and Proctor had decided that Roosevelt must be given the news at once.

When the initial reports were confirmed by another telephone call, Roosevelt, laboring under emotion, asked Proctor to inform the crowd waiting for him on the lawn. He then dictated a telegram and waited for further news. When it was learned that McKinley's wound was not necessarily fatal, Roosevelt hurried to the veranda and made the reassuring announcement himself.

The return to Burlington was made aboard the yacht of Dr. W. Seward Webb, a trustee of the Rutland Railroad. When the dock was reached, at 8:00 P.M., a special train was there to take Roosevelt and his party to



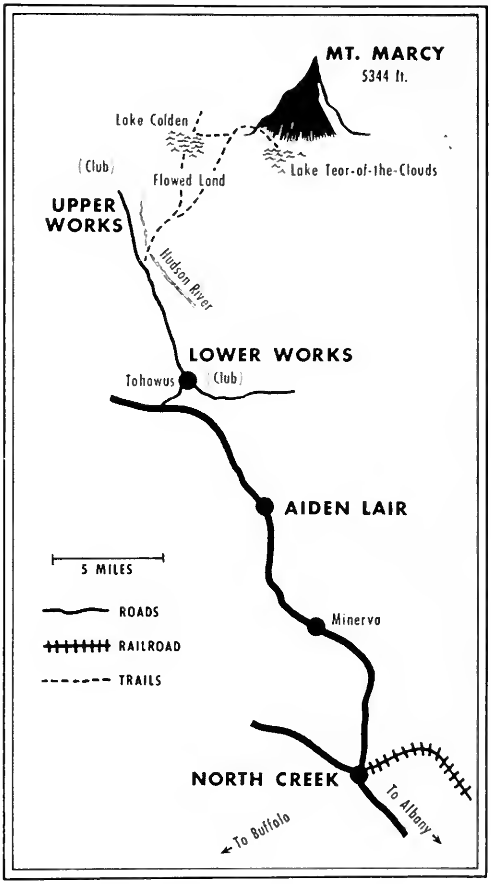
President William McKinley and Vice President Theodore Roosevelt sat for this picture in the fateful year 1901

Buffalo. At the dock, his friends, in person or by message, urged him, in view of the delicate situation, to avoid Buffalo and to go either to Washington or to his home on Long Island. However, as he later wrote in a letter, TR decided to do what seemed natural for him and to hope that it would turn out to be the right thing. He felt a genuine affection for McKinley and believed it more dignified for the second officer of the Government to learn of the President's condition directly.

In Buffalo the following day a haggard TR learned from the attending physician that the President's recovery seemed "almost as certain as anything human can be." But he accepted the invitation of a local lawyer to occupy his home rather than put up at the principal hotel, conferred with the members of the Cabinet, and remained near the President.

To the Adirondacks

At the end of three days, with McKinley's condition better hour by hour, Roosevelt left Buffalo to join his family, who were at a sportsman's club in the forests of the Adirondack Mountains in New York State. He arrived at the end of the railroad at North Creek on Wednesday, September 10, and drove twenty-five miles over rutted country roads in an open buckboard, arriving at the Tahawus Club drenched from a cloudburst. Mrs. Roosevelt had driven down to this point—now Tahawus but then called the Lower Works, since the buildings had originally served as offices for an iron mine—and the two then proceeded another ten miles farther into the mountains to club property at the so-called Upper Works.



The general Adirondack Mountain area in which the Roosevelts were vacationing in the early part of September, 1901

Here their children, a governess, and a maid, were established in a little two-story cottage on the banks of the Hudson River, which is just a small stream at that spot.

Roosevelt was happy to arrive, reported McKinley entirely out of danger, and proposed that they spend several days in the mountains. As the roads were uncertain after the storm, he suggested that they defer their departure until after the weekend. For one thing, he declared, he wanted to climb Mt. Marcy, the high-

The summit of Mt. Marcy as seen from Lake Tear-of-the-Clouds. It was here that Theodore Roosevelt received the summons to return to Buffalo without delay

est peak in New York State, which he had never mastered.

The Telephone in 1901

At that period, the lines of the American Telephone and Telegraph Company extended along the Atlantic Coast from New England to Savannah, to Mobile on the Gulf, and to Little Rock beyond the Mississippi. They also reached many Great Lakes points, stretched westward to Omaha, and touched Lake Superior at Duluth. Since 1888 a long distance line had linked Buffalo, Utica, and Albany, extending not far distant from the southern edge of the Adirondack Mountain country. Further, since 1885 a telephone line had run from Albany to Saratoga Springs and Lake George, and a few small companies actually had lines into the mountains.

In the area in which the Roosevelts were then staying, the principal means of communication was by telegraph in to North Creek, the rail head. However, Louis (Lew) Pereau had connected North Creek with the Lower Works twenty-five miles away by a single-wire grounded telephone circuit, which also linked one telephone at the intermediate points of Minerva and Aiden Lair. Lew operated this service under the name of the North Creek Telephone Company, which later became the North Creek and Chestertown Telephone Company, predecessor to the present company, the Upstate Telephone Corporation.

Thus, TR was actually in one of the few primitive regions of the United States which at that time was not practically devoid of telephone communication.

Up Mt. Marcy

The afternoon after Roosevelt's arrival at the club, the whole party set forth according to plan, leaving behind Quentin, aged four, with the maid, but taking two young Harvard law students and two guides. Just before they started, word had reached the Upper Works that the President was in "splendid" condition.

Anxiety thus relieved, the party tramped five miles up the trail toward Mt. Marcy to an area known as the Flowed Land and then went by canoe to the western end of Colden Lake, where the group occupied two cabins. After breakfast the following morning, the party divided: Mrs. Roosevelt, with the children, returning to the cottage at the Upper Works and TR, his host—the president of the Tahawus Club—and the two students and the guides taking the trail up the mountain.

The President's Condition Changes

In the meantime, in the middle of the morning down at the Upper Works, a team and buckboard spattered with mud dashed along side the clubhouse. The club superintendent went out to hail the driver and see what was up. When he returned, his face was grave and he held a telegram which had been telephoned from North Creek to the Lower Works. There it had been taken down by Mike Breen, who, with his wife, presided over the house on the mining property.

"Boys," he called to several guides before the fire, "there's bad news from the President. Somebody's got to carry a telegram to Mr. Roosevelt." An experienced woodsman named Harrison Hall was chosen for the task.

There had been a crisis in Buffalo in the night. The President had suffered what at first appeared to be a slight digestive disturbance but which developed into something serious. Elihu Root, Secretary of War, was called out of bed in his house up the street from where McKinley lay. Roosevelt must be summoned. Root telephoned the house of the lawyer who had been TR's host. Where was the Vice President and how could he be reached?

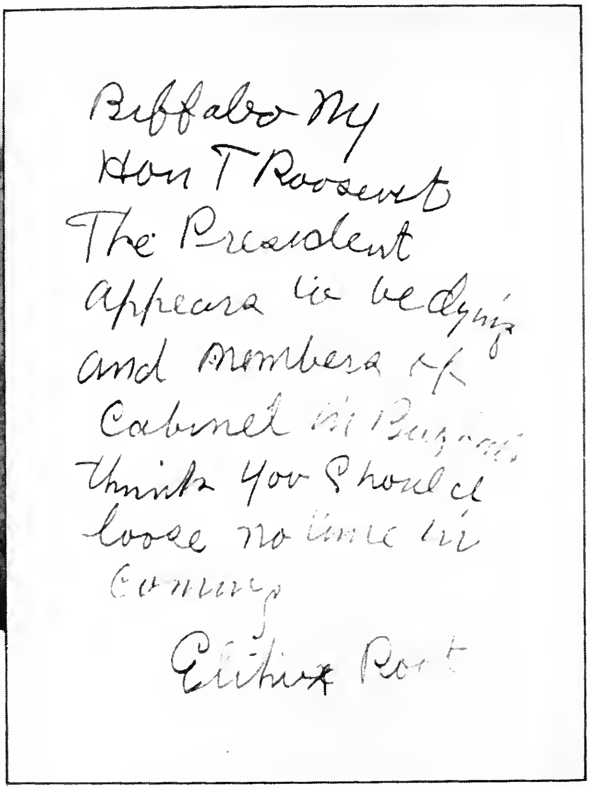
As we know, he could be reached by telegraph, telephone, and a husky mountain guide.

Shortly after the noon hour, Roosevelt and his party reached the summit of Mt. Marcy and found themselves on a rocky peak 5,344 feet above sea level, in clouds which broke occasionally to let them enjoy tantalizing vistas of blue ridges seen through the drifting mist. After a 20-minute stay, they descended a thousand feet to

Log cabin on the shore of Lake Colden

Above: Mike Breen, who accepted over the telephone and wrote down the series of historic messages addressed to Mr. Roosevelt

Below: The summons, in Mr. Breen's own handwriting



Buffalo NY
Hon T Roosevelt
The President
appears to be dying
and members of
Cabinet in Buffalo
thinks you should
lose no time in
coming
Elihu Root

Lake Tear-of-the-Clouds, highest in the State, and at about 2:00 P.M. settled down to eat beside a little brook which is the ultimate source of the Hudson.

Suddenly the woodsman Hall appeared out of a thicket, coming toward them up the trail. Crossing the stream, he approached the Vice President and handed him a slip of paper.

Many years later, Roosevelt told a friend: "I was perfectly happy until I saw the runner some distance away. I had had a bully tramp and was looking forward to dinner with the interest only an appetite worked up in the woods gives you. When I saw the runner, I instinctively knew he had bad news, the worst news in the world."

Roosevelt took the paper, and drew away a little distance to read Root's message: "Buffalo, N. Y. Hon. T. Roosevelt. The President appears to be dying and members of cabinet in Buffalo think you should lose no time in coming. Elihu Root."

The Vice President stood in silence a moment, then told his companions what the note said, and announced that he must return to the club house.

Heading Back to Camp

AFTER hurriedly finishing the meal, the party started down the mountain. At the Flowed Land they divided, Roosevelt proceeding to the Upper Works with one guide, and the rest returning to Camp Colden. When the Vice President joined Mrs. Roosevelt and the children at the house at 5:30 that afternoon, no further word had come from Buffalo.

Unless he was definitely and finally needed, TR told his wife, he was not going to Buffalo again but would wait there. However, he took the precaution of sending a messenger to the Lower Works, ten miles away, to arrange for relays of horses in case he should be called and to pick up any later messages.

As the late afternoon and evening wore on, Mike Breen continued to take down various messages telephoned from North Creek—from McKinley's secretary, George B. Cortelyou, who reported on the increasing gravity of the President's condition; from TR's private secretary, William Loeb, Jr., who reported that he was on the way from Albany with a special train; and from various newspaper men requesting permission to accompany Roosevelt to Buffalo.

In Buffalo, as hope for the President faded, the grief-stricken members of the Cabinet were filing into his bedroom to look on their chief for the last time. Soon the personal bodyguard of the President dashed through the rain to a press tent set up across the street and shouted to the telegraph operator: "Rush this to Roosevelt!"

The Ride Through the Night

BETWEEN ten and eleven that evening at the Tahawus Club at the Upper Works, there was a knock on the Roosevelts' door. It was the messenger, back from the Lower Works with reports of a telephone talk he had had with Loeb, the Vice President's secretary, who was at the North Creek railroad station. McKinley was in a coma and a telegram, delayed in transit, stated that it was imperative for the Vice President to come to Buffalo at once.

Roosevelt threw on his clothes and jumped into a waiting buckboard. The driver hurried him in total darkness down the rough and winding road, arriving at the Lower Works at 1:00 A.M. Here the Vice President telephoned Loeb in North Creek to say he was on his way.

The Adirondacks Stage Company had arranged for the necessary relays, and one of the surest drivers in the North Woods was ready with

Driver and team: Mike Cronin and the rig which carried Mr. Roosevelt on the last lap of the journey through the dark to the North Creek railroad station fresh horses. Under ordinary circumstances the next lap, to Aiden Lair, nine miles away, was a somewhat better stretch of road. But a misty rain was falling and the driver, scarcely able to see the horses' heads, could only trust to his instinct to guide them as they sped along the rutted road. Roosevelt made no effort to converse with his driver on this wild ride but remained given up to his thoughts. At 3:15 A.M. the rig pulled into Aiden Lair, sixteen miles from the Delaware & Hudson terminus at North Creek.

Mike Cronin, keeper of the lodge there and a spirited Irishman in his middle thirties, had been watching the road for hours. Soon his black horses and surrey were dashing southward over the road they had known three or four times a week all summer. Except for an occasional query as to the distance remaining, and a word to urge that the speed be kept up, Roosevelt continued in silence. For him, it was a race with death.

Yet, curiously enough, the driver beside him knew that the race was already lost.

A telegram, received at North Creek, had been telephoned to him at Aiden Lair shortly before Roosevelt's arrival in the early hours of that September 14. It read: "Hon. Theodore Roosevelt, North Creek, N. Y. The President died at 2:15 this morning. John Hay, Secretary of State."

With his backwoodsman's independence, Cronin had taken it upon himself to decide when to deliver this momentous news. Why agitate Roosevelt unnecessarily during the hard journey? Why not wait until they reached North Creek? So he kept the news secret, determining what the mud-spattered but impressive figure beside him should and should not know.

As the sky was graying a few minutes after five o'clock, the foam-flecked horses drew up beside the waiting train at the North Creek railroad station. Loeb was there, and Cronin gave him the slip of paper with the telephoned message. The secretary passed it on to Roosevelt, who read it with tight lips. The paper fluttered to the platform but he bent down and picked it up, thrusting it into his pocket as he boarded the train for Buffalo—and the Presidency.

Who's Who & What's What

(*Continued from page 173*)

meeting ground. Mr. Williams joined the Long Lines Department in 1926, and has had various responsibilities since then—including that of Editor of *Long Lines Magazine*. During World War II he was a member of the House Magazine Advisory Committee of the War Finance Staff of the U. S. Treasury Department, and in 1943 was chairman of the Wartime Conference of the National Council of Industrial Editors' Association held in New York.

(The picture of McKinley and Roosevelt seated is used by courtesy of the Roosevelt Memorial Association. Mr. Welles was instrumental in obtaining from local residents a number of invaluable pictures and records, including the log cabin at Lake Colden, Mr. Cronin and his team, and Mr. Breen and the irreplaceable original copy in his own hand of the message from Root summoning Roosevelt to Buffalo. The picture of Mt. Marcy is from Gendreau.)

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B & T

MAGAZINE

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Bell Telephone Magazine

Winter 1951-52

A Medium of Suggestion & a Record of Progress

Published for the supervisory forces of the Bell System by the Information Department of American Telephone and Telegraph Co., *195 Broadway, New York 7, N. Y.*
Cleo F. Craig, *President;* Carroll O. Bickelhaupt, *Sec.;* Donald R. Belcher, *Treas.*

Who's Who & What's What *in This Issue*

TWO YEARS' Army service in World War I and a short period of other employment preceded ERLE S. MINER's entry into the Southwestern Bell Telephone Company in 1922. Here his work in the Plant Department included assignments as central office repairman, division plant engineer, general plant installation supervisor, and general plant training supervisor, and gave him a first-hand view of the Bell System's training and safety programs from both the practical and administrative viewpoints. In 1929 he transferred to the Department of Operation and Engineering of the A. T. & T. Company, to work on plant training problems. In 1937 he became safety engineer—the office he now holds. The present is Mr. Miner's fifth contribution to this MAGAZINE on the topic of safety, the most recent previous one having been "Promoting Safety in Our Automotive Fleet," in the issue for Autum 1948.

THE BELL SYSTEM career of Dr. OLIVER E. BUCKLEY, Chairman of the Board of the Laboratories, was more fully reported in the last issue—Autumn 1951—of this MAGAZINE, in which appeared *Part I* of his "Post-War Achievements of Bell Laboratories."

OF HIS 26 YEARS in the Bell System, J. N. STANBERY has spent the last 11 years in personnel work. He joined the Illinois Bell Telephone Company's Plant Department in 1925, and after a year of rotational training in various craft jobs he was assigned to staff work. Later he served as wire chief, district plant superintendent, and division plant supervisor, and in 1940 he became general plant employment supervisor for the company's Chicago Area. Two years later he left the Plant Department to become General Personnel Manager, and since 1946 he has been Vice President in charge of personnel.

WHEN ERNEST W. BAKER became Chief Engineer of the Western Area of the Bell Telephone Company of Pennsylvania last September, he returned to the company

Erle S. Miner

Oliver E. Buckley

J. N. Stanbery

Ernest W. Baker

F. Selwyn Gay

Emil B. Voelcker

with which he had started as an engineering assistant 27 years before. In Harrisburg, Pa., from 1924 to 1930, his responsibilities increased until, as plant transmission engineer, he was in charge of all phases of transmission work in the general plant office of the company's Central Area. Then he transferred to the A. T. & T. Company's O. & E. Department, and progressed through steps which found him by 1939 engineer in charge of the toll transmission group in the Plant Engineering Division. From 1945 to 1950 he was head of the group planning for nationwide toll dialing—which accounts for his present contribution—and then, until he went back to Pennsylvania, he was A. T. & T.'s Plant Extension Engineer.

After graduating from the U. S. Military Academy and serving in the Army in this country and Hawaii, F. Selwyn Gay joined the Bell Telephone Company of Pennsylvania in 1923. Two years later he transferred to the Commercial Department of the New York Telephone Company; and in 1929 he transferred to the Commercial Division of the A. T. & T. Company's O. & E. Department. Beginning in December 1941, he served for more than a year in the Administration Division, where he worked on defense and war activities, and he then became technical advisor to the Director of the U. S. Office of Civilian Defense until October 1943. Returning to the Commercial Division, he was engaged for a period in rate activities. In 1945 he was appointed trade mark service manager; in 1946, commercial staff engineer; and, in 1949, directory engineer—his present post. Mr. Gay has contributed two previous articles to this Magazine. The last, in the issue of June 1942, was "The Role of the Telephone in the Civilian Defense Organization."

Emil B. Voelcker joined the New York Telephone Company in 1923, and during the next 17 years his positions in the Commercial Department there included those of directory problems engineer, business office problems engineer, and staff engineer. In 1940 he was assistant director in charge of personnel training for the Bell System exhibit at the New York World's Fair—an undertaking in public relations which required the services of some 400 friendly, courteous telephone men and women. From 1942 to 1945 he served as assistant civilian defense coördinator. In the latter year he transferred to A. T. & T.'s O. & E. Department, where since that time he has been engaged in directory work.

Bell System tools and equipment are designed and selected to enable those who use them to work safely and efficiently. This construction truck, for example, with its array of tools and supplies, cost about $9,500—which is less than half the average investment in tools and equipment behind each telephone job. See "The Telephone Company As a Place to Work," beginning on page 239

Communications Industry Consistently Holds First Place In National Safety Council Annual Reports, with Results Four and a Half Times Better Than the Average

Bell System Safety Record Continues to Improve

Erle S. Miner

Introductory Note, by the Head of the Department of Operation and Engineering

It seems fitting that this article should be dedicated to the 550,000 men and women who have worked long and hard to occupy "first position" in American industry in the field of accident prevention. As telephone folks, we are proud of this record. Such splendid progress has been made possible because of teamwork based on good day-to-day relationships and right thinking. These have enabled the techniques and tools we use in the cause of safety to become effective.

We all recognize that there is nothing really to shout about as long as we continue to get hurt in the performance of our work. Accidents are a waste of human life, cause suffering and financial losses to employees and their families, and indicate inefficiencies in operation. We know the only good safety record is *"no accidents."*

I feel sure that with the pooled knowledge of thousands of telephone men and women gained through years of experience, further progress in reducing accidents to telephone people on the job, in the homes, and on the streets and highways will be made.

F. R. Kappel, *Vice President*

The communications industry * is four and a half times safer than the average for all industries and consistently in first place in the National Safety Council's annual safety report. Not only have the Operating Companies of the Bell System remained at the top in safety results, but they have also continued to improve during each of the last seven years.

* Predominantly Bell System results.

The following words have become the policy of safety in the Bell System:

NO JOB IS SO IMPORTANT AND NO SERVICE IS SO URGENT— THAT WE CAN NOT TAKE TIME TO PERFORM OUR WORK SAFELY.

The part which teamwork has played in preventing accidents is well illustrated by the achievements during these years of progress.

Some of the Bell System Companies operated year after year with an accident frequency rate as much as five times higher than other System Companies. The difference was marked, even though they all performed the same type of work, used the same type of tools, drove the same kind of trucks, and employed the same calibre of personnel. Such variations in results became even more perplexing when it was realized that the Companies had all indicated an interest in eliminating accidents and have had safety programs. Furthermore, there were no secrets nor patented processes concerning any part of those safety programs. This is an activity wherein there is full coöperation and interchange of ideas, plans, and programs between Bell System Companies and other industries to eliminate accidents.

What could account for so great a variation in results?

We know now that there is no one answer to that question. It can be found only through studying the successful practices and procedures of the groups and departments and Companies having the best safety records.

Let's look, then, at some of the basic philosophy, developments, and activities which, based on combined experience, make up the present safety programs of the Bell System telephone companies.

Acceptance of Responsibility Is The Key to Safety

ONE OF THE Companies having an outstanding safety record for a long period of years has expressed briefly the fundamentals of its safety program: (1) impress on every individual his responsibility for his own safety, and (2) impress on supervisors at every level their responsibility for the safety of their people.

This means that to the extent to which each member of the staff is responsible for operations, to the same extent is he or she responsible for the safety of such operations. When a department head is given a job, the safety of every employee goes with it. Every chief operator, commercial manager, engineer, foreman, or group leader is responsible for the employees he or she supervises. And every person has the responsibility of doing his work safely and of doing what he can do to protect himself, his fellow employees, and the public. This "acceptance of responsibility" by everyone has been found to be the key to improved safety. *It is Number One in importance.*

Proper Thinking—"Six Murderous Beliefs" and Others

WHILE they had not been dubbed "public enemies" or "murderous beliefs," certain concepts had been recognized as making the prevention

The operation and maintenance of new types of plant and tools, exemplified by this isolated radio relay tower and equipment, introduces new safety problems

of accidents extremely and unnecessarily difficult. And this was probably just as true in the telephone business as in most other industries.

These six wrong or misleading beliefs * are:

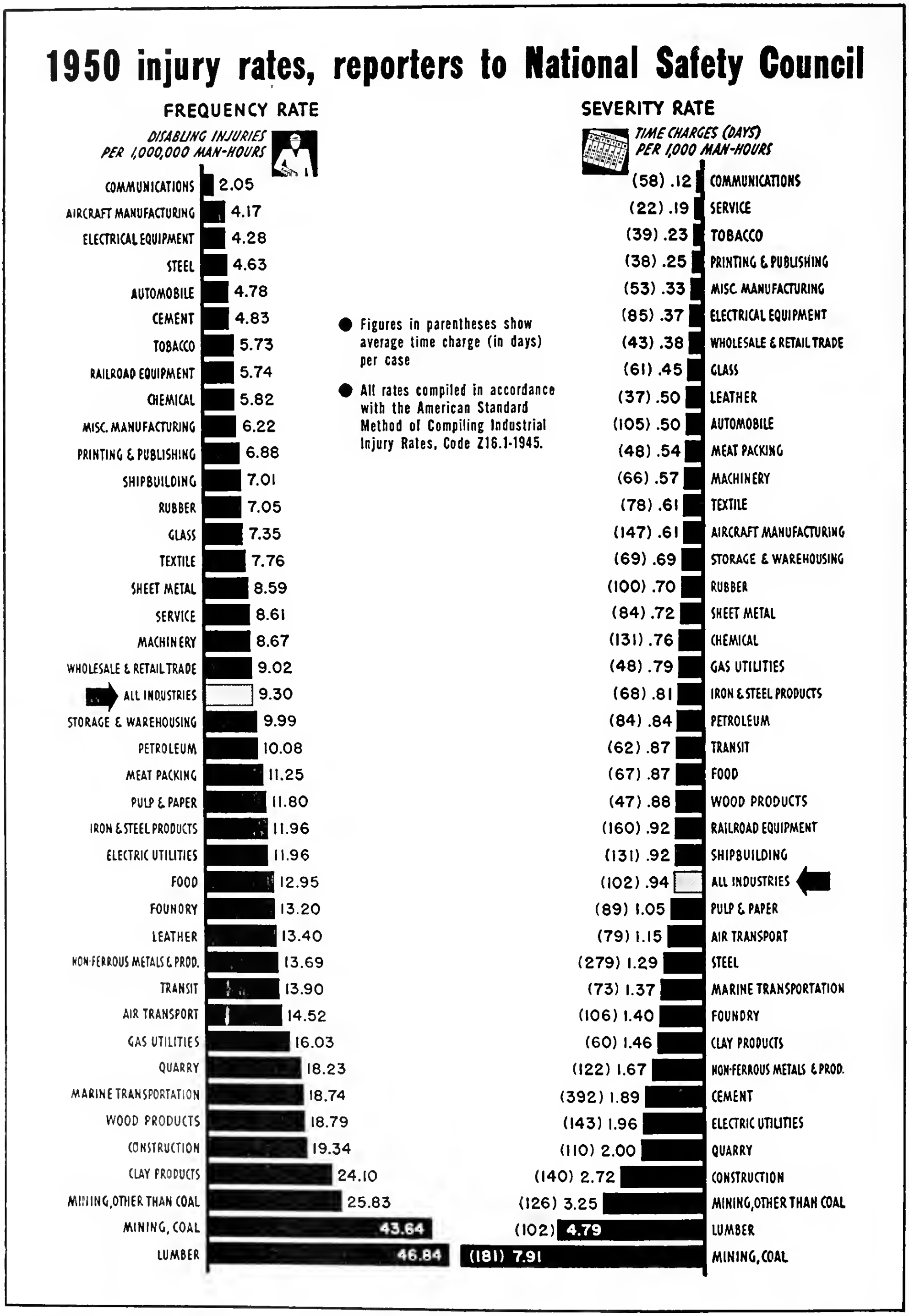
1. The "Other Fellow" Concept

This is the assumption that an accident may happen to the other fellow but never to us; that we are smarter, or luckier, than the other fellow, and that accident victims must be "dopes."

2. The "Your Number's Up" Concept

Some have the philosophy that an accident either happens or it doesn't: that "your number is up"—or it isn't.

* Taken from an address entitled "Six Murderous Beliefs" by Ned H. Dearborn, President National Safety Council, Chicago, on October 6, 1947.



"Accident Facts," published each year by the National Safety Council, shows the Communications Industry in top position

3. The "Law of Averages" Concept
People shrug off accidental death and injury, feeling that a certain number of persons are doomed to destruction despite reasonable precautions.
4. The "Price of Progress" Concept
It is often said that accidents are the natural price paid for progress—that people have to be maimed or killed as the price for modern living.
5. The "Spirit of '76" Concept
Some people hold that safety precautions are inconsistent with the spirit of our forefathers—and, worse, that accident prevention is cowardly.
6. The "Act of God" Concept
Some folks feel that an accident in an act of God, inflicting divine punishment on us and our loved ones.

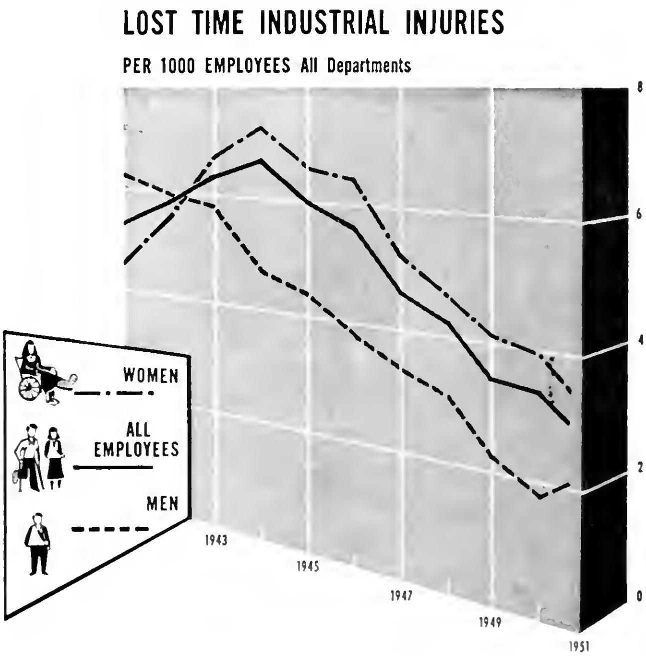
While these six murderous beliefs, in some variation or other, have hindered the progress of accident prevention, there are also such alleged causes as climatic conditions, increased size of force, accident proneness, age, length of service, and hard luck. It has been found that the accidents assigned to these classifications are also preventable through well administered safety programs.

So, along with the purging of such wrong and misleading beliefs, which have had a bad influence and made the prevention of accidents unnecessarily difficult, has come the acceptance of better and more promising beliefs or creeds. These have improved attitudes, helped to make safety something positive and real and practical, and made accident prevention easier.

Employee Attitudes, Alertness and Behavior Are Important

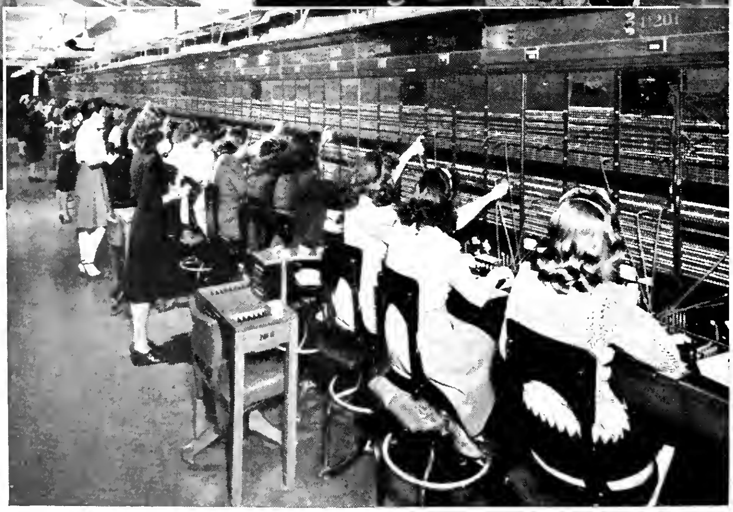
A STUDY of accidents that do occur in the telephone industry has indicated that the greatest improvement in safety will continue to come from giving special attention to the "human factors."

Here are a couple of examples of recent cases which illustrate the point:



Telephone folks have a right to feel proud of their safety record, which has improved each year for the last seven years

The responsibility for the safety of employees goes along with the appointment of all managerial people



A switchboard operator, on reaching the fifth step from the bottom of the stairs without holding on to the hand rail, caught the heel of her shoe in the hem of her skirt and fell to the bottom of the stairs. She received a scalp wound above her ear and a wrenched shoulder, necessitating four weeks' absence.

Two repairmen driving to a job following a severe wind storm agreed that "On every job today, we will wear rubber gloves." They parked their truck and proceeded to check for a broken telephone drop wire. One repairman said "here it is," and took hold of a wire which was hanging low over some brush. That was a fatal error, for he had mistaken a 2,300-volt power wire for the telephone drop wire. Two pairs of rubber gloves were on the truck, and had not been used that morning by either employee.

These cases illustrate accidents that would have been avoided if employees had kept alert and followed the ordinary, well understood, and generally accepted safe practices that have been established for their own protection.

Employee Attitudes, Coöperation, And Teamwork

WHENEVER the quantity and quality of production are at a high level, misunderstandings are few and accident records are good. This situation can be traced to supervision of high order in this matter of understanding and working harmoniously with people. The aim of human relations in safety activities is to provide positive and effective leadership so that the group will want to work effectively and coöperatively toward eliminating accidents.

The causes of haste, carelessness, abstraction, forgetfulness, or poor attitude which may lead to accidents can be known to a supervisor if he

Safety lessons help the man to work with his head, hands, and heart, and thus become his own safety expert will but build a sound foundation of understanding. This he can do by discussing not only the items that he wants to talk about but the matters that are important to his people as well. Thus the supervisor, by recognizing many of the human behavior factors before they cause accidents, may spend his efforts in preventing accidents rather than in making reports after accidents occur.

We have to understand what motivates people—what are their wants and needs. These include such things as the needs for recognition, job satisfaction, self-expression, and self-respect. When these are disturbed, we may expect behavior not conducive to safe and careful work. Then, when we provide the satifiers of these motives—such as participation, sharing of responsibilities, praise, right treatment—we are improving the behavior of the man and helping him to work with his head, his hands, and his heart, and thus to become his own safety expert.

What about people's attitude? It does little good to tell a person that he or she must have a safe attitude. A correct attitude toward safety can be built only by a series of satisfying, helpful experiences: discussions, for example, on specific things that people should or should not do on their jobs, on definite operations, and on solving actual problems.

No less valuable an attitude builder is the example that supervisors, staff personnel, and other management people set by their own

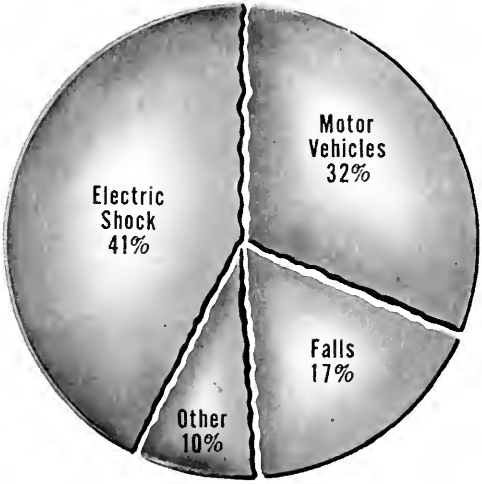
An individual trained in first aid develops a sense of responsibility for his own safety, for the safety of his family, and for the safety of his fellow workers and the public actions and attitudes. Their own examples and attitudes must reflect safety every time, without exception.

Building Proper Safety Attitudes, Alertness, and Behavior

MANY of the safety activities included in successful Company safety programs have a direct bearing on the development of proper employee motivation, attitude, and behavior. First-aid training, motion pictures, film strips, safety graphs, safety publications, statistics, posters, safety meetings, safety award plans, pre-job analysis, safety observation plan, safety lessons, model equipment—these are but a few. The programming of all these activities, focused to do the most good at the particular place and time, makes a man or woman *think* safety and *feel* that safety is important.

An effective addition to the Company safety programs has been the safety observation plan, designed so that unsafe practices and their underlying causes can be determined and measures taken to eliminate or correct them before an accident occurs. Regular observations are made of

> *The records show that telephone men and women generally have five to ten times as many accidents off the job as at work. While this speaks well for on-the-job safety efforts, it is encouraging that some of the procedures found effective in reducing accidents on the job are applicable to reducing accidents off the job. Many of the Companies are now furnishing information designed to eliminate the tragedy of home accidents to employees and their families.*



Electric shock, motor vehicles, and falls are the causes of 90 per cent of the fatalities to Bell System people. Activities focused on their prevention make up a large part of the safety programs

work in progress, adherence to safe operating is noted, and the practices themselves are studied to see if they are adequate. Results of safety observations are summarized and form a basis for review training and for putting safety on a preventive rather than a corrective basis.

All Bell Companies have in their safety programs routines for reporting unsafe plant conditions. Everyone in the business is encouraged to report broken tools, rotted poles, power wire exposures, damaged tires, corroded wire, faulty equipment, and similar accident-prone situations. It is the stated policy of the Bell System Companies to provide tools, materials, and equipment which are safe when used with reasonable skill and care. Every effort is made to design plant that may be constructed and maintained without risk of accident.

Comparative reports on all types

of accidents are issued periodically. These keep everyone informed as to the causes of accidents and serve to stimulate interest and friendly rivalry. Information for the reports is furnished by all the Bell Companies, illustrating the coöperative endeavor throughout the System to help all employees avoid injuries.

First-aid training was introduced in the Bell System almost 40 years ago with the assistance and coöperation of the American Red Cross. During World War II, civilian defense organizations and Red Cross chapters had thousands of telephone people in their ranks as first-aid instructors. In the present national emergency, first-aid training programs have been accelerated and telephone employees once again are forming an important part of such organizations.

When we give a man employment in this business, he has a right to expect that we will point out to him any hazard that he is likely to face in any operation he is asked to perform. He also has a right to expect that we will show him how to avoid that hazard. He believes we are competent to teach him, to train him, and to supervise his work, so he may perform his assigned tasks safely.

The Bell System, through membership in various organizations—such as National and local Safety Councils, and the American Standards Association—keeps in touch with the progress of safety programs throughout the country. The Telephone Companies also work closely with gas, electric, and power companies and other utilities so that best use may be made of pooled experiences.

Telephone Company engineers have incorporated safety in the design and maintenance of trucks and other motor vehicle equipment

The Bell System operates some 55,000 trucks and motor vehicles. These vehicles, along with winches, derricks, polehole diggers, trailers, cable plows, tractors, and other heavy power equipment, present a substantial exposure to accidents. With the growth in traffic on the country's streets and highways, the operation of all this equipment has become increasingly difficult. In the final analysis, the success of the motor vehicle safety program rests in the hands of the 75,000 regular and occasional operators of

> *The "know-how" is demonstrated by one Telephone Company's remarkable record during 1950 of 18,624,000 man-hours without a lost-time accident What is more, the Operating Companies of the Bell System went 14 consecutive months during a recent period without a single fatality.*

this automotive equipment. That is the reason safety programs utilize every possible educational method to develop in each driver an understanding of the techniques of safe driving and to make him feel his responsibilities to himself, his Company, the pedestrians, and other users of the highways.

Plant Department Operates Safely

The Plant Department consists primarily of 157,000 men engaged in the engineering, construction, installation, and maintenance activities of the telephone business. They operate most of the trucks and other motor vehicles. They use a variety of power-operated tools, climb poles, come in close contact with winches and cables, and handle heavy equipment. Much of their work is done on busy streets, in the underground systems under the streets, or along highways during all kinds of weather. Sleet and windstorms, often under blizzard conditions, and hurricanes as well, cause broken trees, poles, and wires.

Rubber gloves and other protective equipment, which are always available, and special precautions to meet best each condition as it arises, prevent accidents at the time of such increased exposures.

It is a notworthy accomplishment that *from 1941 to 1950 the accident frequency rate for plant men was reduced from 6.68 to 1.80 lost-time cases per 1000 men (or from 3.34 to .90 per million hours of exposure), and that during each of the last seven years new all-time low rates were set.* This splendid improvement is further evidence that the Telephone Companies really have under normal conditions no hazardous jobs—provided, of course, that proper tools are used, proper training is given, and everyone follows instructions.

This general improvement means that 666 fewer men were killed performing telephone work during the 20-year period 1931–1950 than would have died had the 1926–1930 rate continued. That is a saving beyond price. It is easy to see why telephone men are proud of their safety record.

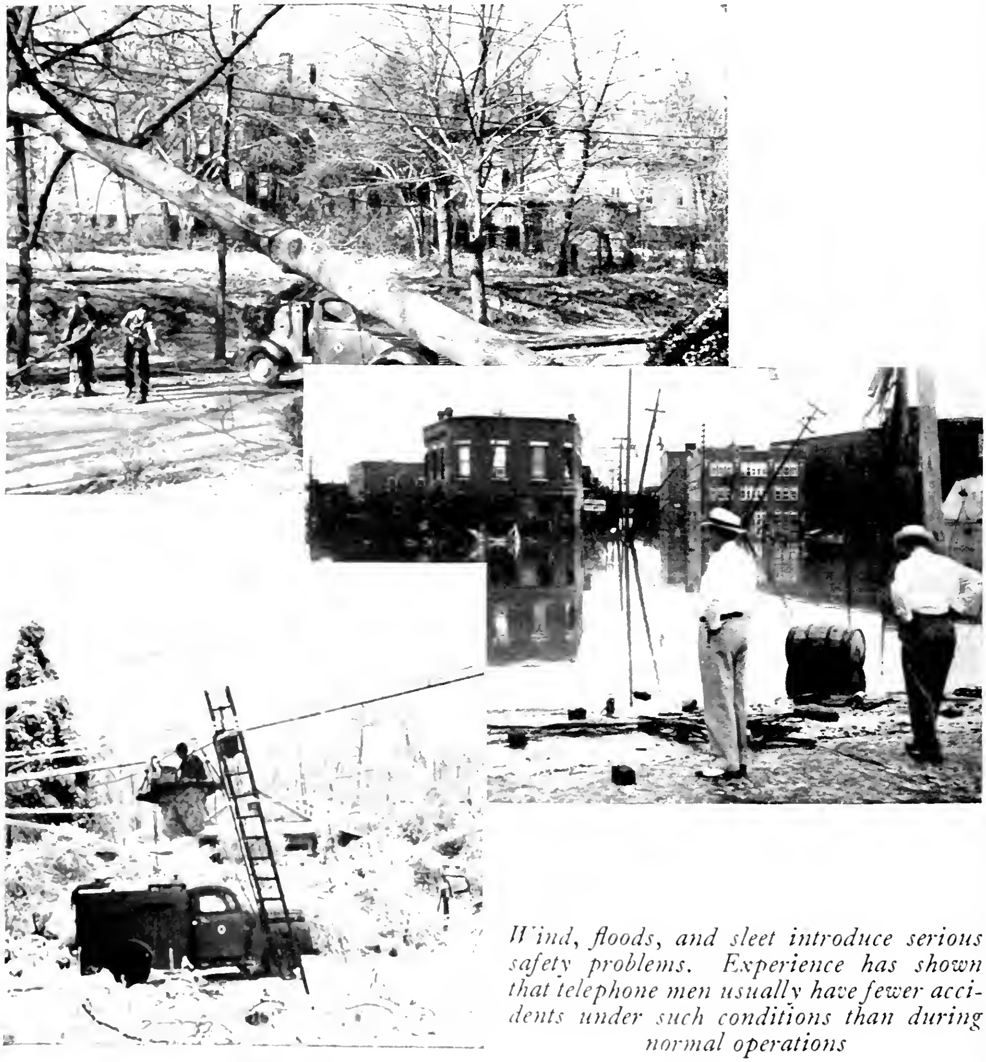
Still other contributions to safety have been made by Bell Telephone Laboratories, by Western Electric Company, and by Telephone Company engineers in building safety into the design, manufacture, and operation of tools, plant, equipment, and motor vehicles. Accident prevention is accepted as part of the planning as well as the execution of every Bell System job.

Traffic, Commercial, and Accounting Conditions

One element in the accident problem among the 262,000 Traffic employees, 50,000 Commercial employees, and 42,000 Accounting employees is care in simple things not related to the technicalities of the job. Such acts as hurrying across floors, in the halls and on the stairs, not looking, not using handrails, leaving desk drawers open, and others, can be hazardous. Job operations requiring special attention among the Traffic forces include cord handling, reaching at the switchboard, carrying head sets, and getting on and off switchboard chairs.

Operations requiring particular attention in the Commercial Department include lifting and motor vehicle driving by the coin collectors. Operation of business machines in the Accounting Department requires special care to prevent accidents.

One of the most effective ways for keeping interest in safety alive in these offices is the Safety Committee. The members of these committees make their own actions safe as an example to the rest of the force; observe the actions and attitudes of employees, particularly the newer ones;



Wind, floods, and sleet introduce serious safety problems. Experience has shown that telephone men usually have fewer accidents under such conditions than during normal operations note the condition of buildings; and investigate accidents after they occur and suggest suitable remedial action. Both management and non-management employees are included, and to insure a wide interest the members of the committee are frequently changed.

A Look Ahead

THE PRESENT APPROACH to accident prevention is a practical one. Accident prevention is part of the regular job. It is balanced with efforts to maintain service and control costs. It is kept as simple as possible.

It all adds up to the splendid over-all improvement during recent years which was referred to at the beginning of this article.

There can be no let-up if our present performance is to be maintained and improved. We must constantly look for ways and means that will be most productive of results. We must detect weak spots, particularly accident-prone groups of people, districts, or divisions—and apply remedial measures as required.

That we may look forward to even greater improvements in safety seems assured, because the telephone teams, in all departments, in thousands of communities, have buried forever the wrong beliefs that accidents are unavoidable, inevitable, predetermined, a matter of luck, badges of distinction, and the price of modern living. They have substituted in their place positive beliefs that accidents can be stopped by alert, wide-awake telephone folks with the knowledge and determination to stop them.

Our Greatest Asset Is *Ourselves*

Cleo F. Craig

The following is from the remarks of the A. T & T. Co. President before the General Assembly of the Telephone Pioneers of America in Louisville, Kentucky, on September 27, 1951

I CONFESS that, looking back over the last ten years, I find it a little hard to believe that we have really done everything we have. All of us here are people of long experience in the business. Who among us ten years ago would have dared to predict even half of what we have accomplished?

We have experienced demand for service that makes all previous demand seem very small indeed. We have been under exacting, continuous pressure. We have had to build and build and build—and still there has been more to do around the next bend in the road. We have wrestled and we continue to wrestle with shortages of facilities: held orders, regrades, party-line complaints.

We have seen costs rise and keep on rising. We have had to obtain urgently needed increases in rates. Again and again we have had to demonstrate to the commissions and the public, and sometimes to the courts, why we needed more money and were entitled to get it. We are still under this same necessity and it may well go on for a long time.

Add it all up and there is no question that in the last decade we have had to deal with the biggest package of assorted problems in telephone history. It was inevitable that we should meet situations where the going was tough—very tough. It was inevitable that we should have headaches, and sometimes heartaches too. In this respect, however, most of the other people on this continent have kept us company.

BUT DESPITE all the headaches and hurdles, we have made a magnificent record.

Just think of it!

In the Bell System alone there are fifteen million more telephones in service today than there were when the war ended.

We are rendering a far better and more valuable service.

We have improved our efficiency, our equipment, and our methods of operation.

As a result, the over-all increase in rates, large as it has to be in total amount, has been relatively much less than the rise in prices generally. In relation to average family income, the service we render is a bigger bargain and a lesser part of the household budget than it ever was before.

Stockholders of the A. T. & T. Company have increased in number to more than a million—including a quarter of a million Bell System employees. The savings they have put into the business are invested in better equipment than has ever been available at any time in the past.

The proportion of dial telephones has steadily increased.

Local service calling areas have been greatly enlarged.

We are well on the way to nation-wide toll dialing. We are making a start on customer dialing over long distances.

Service to farmers has been widely extended and substantially improved.

We are providing mobile services to thousands of cars, ships, trains and planes.

Radio relay spans the nation, and coaxial cable and microwave radio facilities already bring network television programs within the reach of 85 million people from coast to coast.

Here we are, then, in this 75th Anniversary Year, with the largest and finest telephone plant in history, with the biggest dollars-and-cents telephone value that we have ever been able to offer, and with new developments already in operation that are carrying us farther and farther into a new era in telephone communication.

Here we are, too, with many hard problems still to be met: higher taxes and other higher costs ahead; the threat of inflation always to be reckoned with; urgent defense jobs calling for rush attention.

And now I find myself asking certain questions.

Who designed and manufactured, engineered and built the magnificent plant we use to provide service? We did—telephone men and women working together.

And how do we render this service day by day, and cause it to keep on gaining in usefulness and value? We do it through the labor and devotion of people. Our labor; our devotion.

Who meets the urgencies and emergencies of the moment? I am thinking of the service problems, the construction problems, the long-run cost and financial problems that we have always with us and ahead of us. We do. You and I and all of our fellow workers at all levels of management and in all the ranks.

All our billions of dollars' worth of physical facilities, the whole intricate and wonderful system, would be useless without people.

Sure, we have to have the money.

We have to have the plant.

And we need every invention and improvement that makes it possible to do what couldn't be done before.

We need the screwdriver and we need the microwave.

But just as surely, all these things need us.

Our greatest asset is—*ourselves.*

To you and all Pioneers everywhere, I express my profound admiration for the leadership and influence you have exerted all through the years. The banners have been held high. They will continue to be held high, I know, in the years that are to come. And it is vital that we do so, for we are moving on to events that will shape the future of the world. The responsibilities entrusted to us, the problems we must overcome, may well be greater than any that have yet come to our hand. Our immediate tasks are already tremendous. Who can doubt that our human capacities will be tested to the limit? Not I. But I have faith in the future, and the reason is clear and simple. I have the utmost faith in the people that make up this telephone team of ours.

The Bell System's Research Organization Has Completed More Important Developments in the Past Six Years than In Any Like Period in Its History

Post-War Achievements of Bell Laboratories: II

Oliver E. Buckley

This is the second of two articles by the Chairman of the Board of the Laboratories. In the first, which appeared in the Autumn 1951 issue, the author discussed important advances in transmission systems and apparatus, including a new telephone.

From the standpoint of its effect on future telephone practices, the most significant development in the switching field is undoubtedly the new crossbar switch system for long-distance traffic. To bring this fact out, however, it will be necessary to make a few preliminary remarks; for a crossbar toll dialing system already existed, and the significance of the development lies in the difference between the two.

In manual practice, the toll operator has as her initial information the name of a distant city to which a call is to be placed. She is also provided with a routing book, called her bulletin, which tells her what she must do to set up a connection over the most direct route, and what alternative route to use if an idle circuit on the most direct route is not available.

The toll crossbar switching system which was developed by the Laboratories shortly before the war, and which first went into service in Philadelphia in 1943, was designed around this procedure. The operator was provided with dial equipment, and with a bulletin which told her what numbers to use to obtain a connection to the wanted city. It also told her what action to take in case direct routes were not available.

The switching system, responding to the dial pulses, was able in some cases to set up the connection all the way through to the called telephone without further attention on her part. In other cases, it could only connect

These operators are "key pulsing" (dialing) long distance calls in a toll office

her with another operator at some place from which the wanted city could be reached. Her bulletin told her which of these things to expect, and, in the case of the second alternative, what information the distant operator would need.

It is significant to note that in this bulletin, as in the one used in manual practice, the numbers identify the *circuit* to be used, not the *destination* to which it leads. Hence an operator in New York must have a different bulletin from that used in New Orleans, since the circuits used to reach, say, Covington, Kentucky, would be different in the two cities.

This dial system greatly increased the speed and efficiency of toll operation. It has been installed in a number of other cities since the War and over one-quarter of all long-distance calls are now being handled by it.

National Toll Dialing

We come now to the developments which have taken place during the last five years.

In the first place, a scheme has been worked out for assigning each telephone in the land a *national* directory number; and also a companion scheme for organizing all the trunk routes in the country into direct and alternative paths on a systematic basis. These are features of a nation-wide toll dialing plan, developed by all the Bell System companies working together.

To carry out this plan, a different type of switching system is necessary, and this is what has been designed. It is a system which contains within itself so much of the information now supplied by the operator's bulletin that it can reach a telephone in any dial city on the basis of the national directory number alone. That is, it requires only a number which identifies the *destination*, not one that identifies the *route*. Moreover, the system automatically selects the best available one of several alternative routes, if necessary, without human intervention of any kind.

Such a system will still further simplify the operator's duties, with a corresponding increase in accuracy and speed. Moreover, the number that identifies the destination is unique. Such national numbers could be dialed directly by customers. How far it may eventually be desirable to extend customer dialing is not now certain, but it is clearly important that equipment has been developed which will place no obstacles in its way.

What about the cities in which the older type of equipment has already been installed?

These also have been kept in mind, and the new system is so designed that the older equipment can be converted with a minimum of expense, and without even taking it out of service. This is possible because both systems are of the "common control" type. Such offices consist essentially of two parts. The one which is physically the larger consists of the switches through which connections are established. The other is a set of circuits which store the dial pulses, interpret them in terms of the actions to be taken, search for an idle circuit along a proper route, and then cause the necessary switches to close. It is only in the second part that the new system differs from the old. The arrangement of the switches is the same in both. Therefore, by replacing the older control circuits with the newer ones, it will be possible to adapt any office to operate in accordance with the National Numbering Plan.

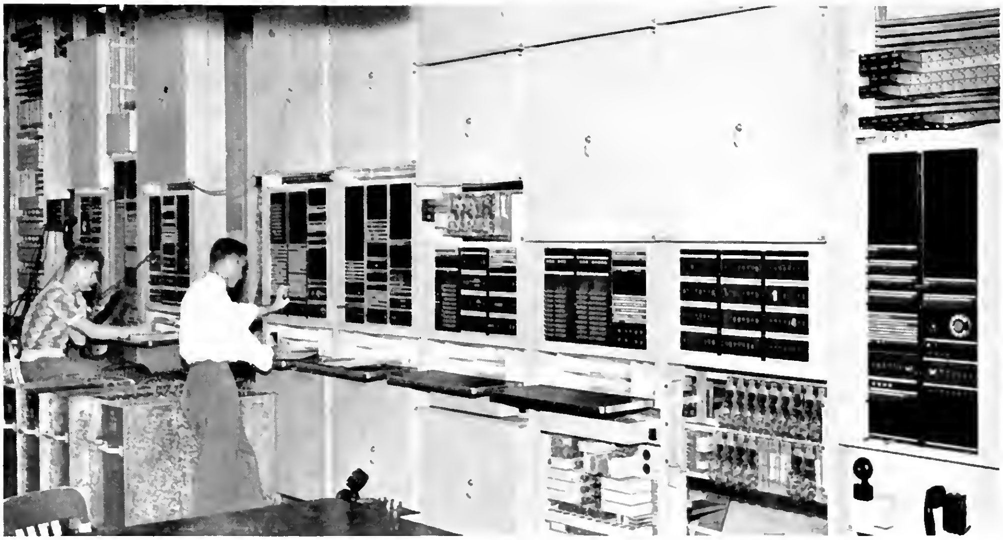
The heart of the system is a new *translator:* a complex device which automatically gives the control equipment all necessary information about the various routes to the wanted telephone, alternative as well as direct. Its role is similar to that of the operator's bulletin * and, like the bulletin, it must be kept up to date as circuits are rerouted from time to time to meet seasonal demands for service or for other reasons. This is easy to do because, by its use, the replacement of one route by another can be done expeditiously and simply.

This new translator is of special interest also for another reason. It is the first Bell System equipment designed to include the transistor, a semi-conductor device that is capable of many of the functions of the vacuum tube.

The first of the new systems will go into service in 1953. By that time, equipment of the older type will already be in use in 19 cities. In all but six of these, however, features anticipatory of the new system are already incorporated, thus simplifying still further the problem of conversion.

The introduction of toll dialing methods has also required new facilities for transmitting over long distance lines the signals which control the operation of the switching equipment. Compared to the signaling systems used in manual toll practice, those needed for dial operation must convey considerably more informa-

* To bring out the significance of the new system, the similarity between the new translator and the operators' bulletin has been emphasized. Their functions are not identical, however, and operators will continue to require bulletins to guide them in handling certain types of calls, even when the national dialing system is fully in operation.



This is the maintenance section for a toll dialing office of the newest type

tion and must do it more rapidly. It was therefore imperative that suitable new signaling systems be made available; otherwise the national dialing program could not have been carried forward efficiently.

Many toll boards, scattered at widely separated places, also required modification so that the operators there could dial calls directly into the toll switching equipment.

Automatic Message Accounting

In order to permit a customer to dial any call for which a charge is made, whether to a point nearby or far away, some means must be provided to obtain the data for his bill. Automatic Message Accounting—or AMA as it is usually called—is the first fully automatic system for collecting and sorting such data. It cares for both bulk-billed traffic, for which only the monthly total is required, and also detail-billed calls that must be individually itemized.

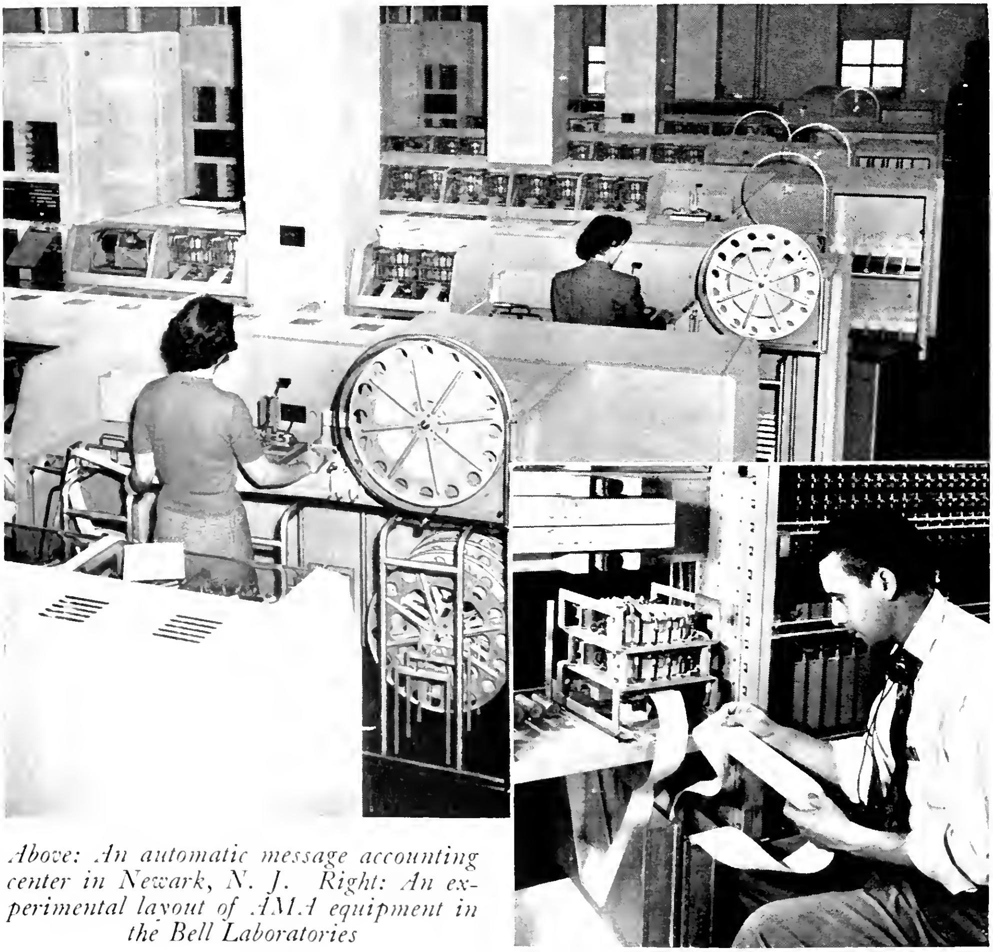
It consists essentially of two parts. The first, which is located at the central office, records the pertinent facts regarding all calls, no matter from what telephone they are made. The record is in the form of holes punched in a continuous paper tape. The amount of detail varies from call to call, being greater for those which will be itemized on the customer's bill than for those which will not.

At suitable intervals these tapes are collected and taken to an accounting center which serves many local offices. Here the second part of the equipment sorts out the items that relate to each customer, arranges them in the order of the directory numbers to which they should be billed, and accumulates the total of the bulk-billed items. It then transcribes the record from the punched tapes into the form best suited to subsequent use. This may be a typewritten record if the remaining steps of the billing routine are manual, or punched cards if the remaining steps are to be carried out with business-machine equipment.

The system is built around two machines designed especially for this purpose. One is a high speed "perforator." It records information on the paper tape under the control of relay circuits not unlike those used to control switching operations in crossbar exchanges. The other is a high speed "reader." This transfers information from a tape to the relay circuits which control a subsequent process—such, for example, as the sorting of calls or the typing of the final record.

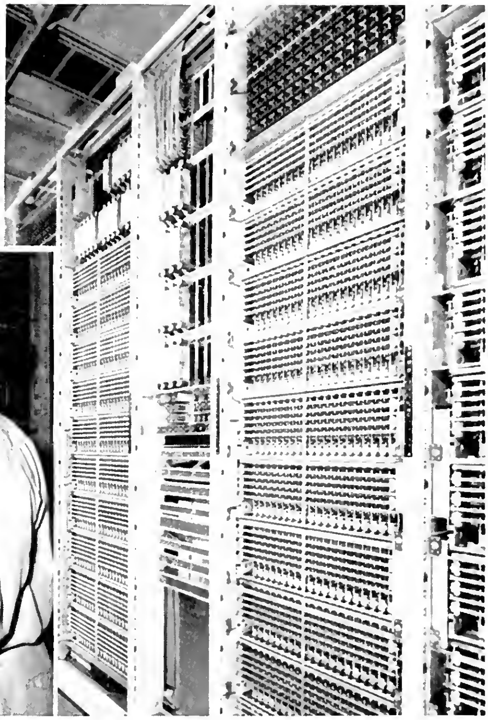
It is worthy of note that the first models of these machines were built in the home workshop of a Bell Laboratories engineer, at a time when the facilities of the Laboratories were still fully engaged with business of World War II. Without this manifestation of his personal enthusiasm and initiative, laboratory experimentation with the system must necessarily have been deferred.

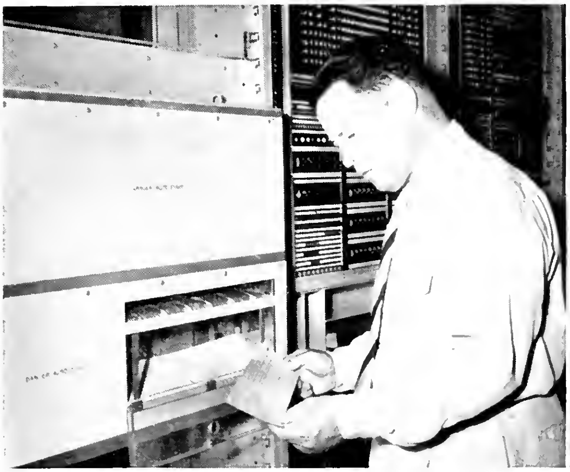
AMA was first placed in service in Philadelphia in 1948. By the end of



Above: An automatic message accounting center in Newark, N. J. Right: An experimental layout of AMA equipment in the Bell Laboratories

Right: Part of the equipment in a No. 5 crossbar dial office. Below: Examining a card report punched by a trouble recorder in a crossbar dial office





1950 there were 32 office installations and 4 accounting centers serving nearly half a million customers. It is now used only to keep account of traffic dialed by customers. The system is a very flexible one, however, and can readily be adapted to handle toll calls dialed in accordance with the national numbering plan, either by the customer or by an operator. Its ultimate field of use will therefore be determined by economic consideration.

Another type of equipment was also developed for use in step-by-step areas. This equipment, which is known as Automatic Ticketing, prints a ticket similar to those prepared by operators when calls are handled manually. The subsequent processes of sorting these tickets and computing the charges are the same as in the case of manual operation. It has been of great value in enabling subscribers to dial a larger proportion of their calls, especially in the Los Angeles metropolitan area. However, its field of use will certainly not be as wide as AMA.

No. 5 Crossbar: A New and Versatile Local Dial System

No. 5 CROSSBAR is a new dial switching system for local offices, which embodies the most modern concepts of design, and is adaptable to a wider variety of needs than any previous system.

It is capable of operating with all present local, tandem, and toll switching systems of the Bell System and of the independent companies which connect with it.

It can serve as a small tandem or toll center where this is advantageous.

It will operate with as few as four digits in the local directory number, or it can accommodate the full 10 digits plus party designation required by the National Numbering Plan.

When equipped with Automatic Message Accounting, it automatically provides the information needed to bill the subscriber correctly, either in bulk or itemized form, for all the calls within his direct dialing range.

Long periods of unattended operation are provided for in various ways. To begin with, the extensive experience of the Operating Companies with other crossbar systems, and the most recent advances in the art of circuit design, have been drawn upon to make this system as nearly trouble-free as possible. When troubles do occur, most of them are detected by the mechanism and circumvented by a second trial, which is made automatically without inconvenience to the customer and indeed without his knowledge.

Simplified alarms direct attention to trouble conditions, and give an indication as to their nature or seriousness. During unattended periods these may be transmitted to another location where there is a maintenance force. Also, when trouble is encountered, a new device, called a "trouble recorder," produces a permanent record, in punched card form, of information which will aid in locating and correcting it. If no one is in attendance, these cards remain available for later reference when someone has occasion to visit the office.

The first installation of No. 5 equipment was made at Media, Pennsylvania, a suburb of Philadelphia, in July 1948, and many of the 50 or more offices which have since been installed are also on the outskirts of large cities.

The versatility of the equipment is especially attractive in such locations, since they present a switching problem more complex in some respects than that of large city exchanges. They usually have a high percentage of toll calls. Many kinds of dial equipment are likely to be found within their direct dialing range. They are frequently too small to justify full-time attendance, so that provision must be made for long periods of unattended operation.

The advantages of the new system are also being put to use to provide an experiment with customer dialing of long-distance calls. This is taking place in Englewood, New Jersey. The subscribers served by this office are able to dial directly to about 11,000,000 telephones, many of them in distant cities. This is not quite as many as are being reached by operator dialing, but is enough to afford a good test of the advantages and problems of this method of operation, and the customer's appreciation of it.

No. 5 crossbar can perform every function required of local switching equipment in any type of community, and, with all its advantages, it is confidently expected that the system will have a very wide field of use.

Equipment for the Operating Room

In providing new services to the public and making the old ones better and more economical, the Bell System does not lose sight of the welfare and convenience of its own employees. Such considerations loomed large in designing the equipment which we are now to discuss.

The method of handling toll traffic which was common some years back required large arrays of lamps and jacks before each operator. The backs of switchboards, therefore, had to be made quite high. The pulleys and weights which held the cords also required space, and this was obtained by placing the switchboard on a platform or seating the operators on high chairs.

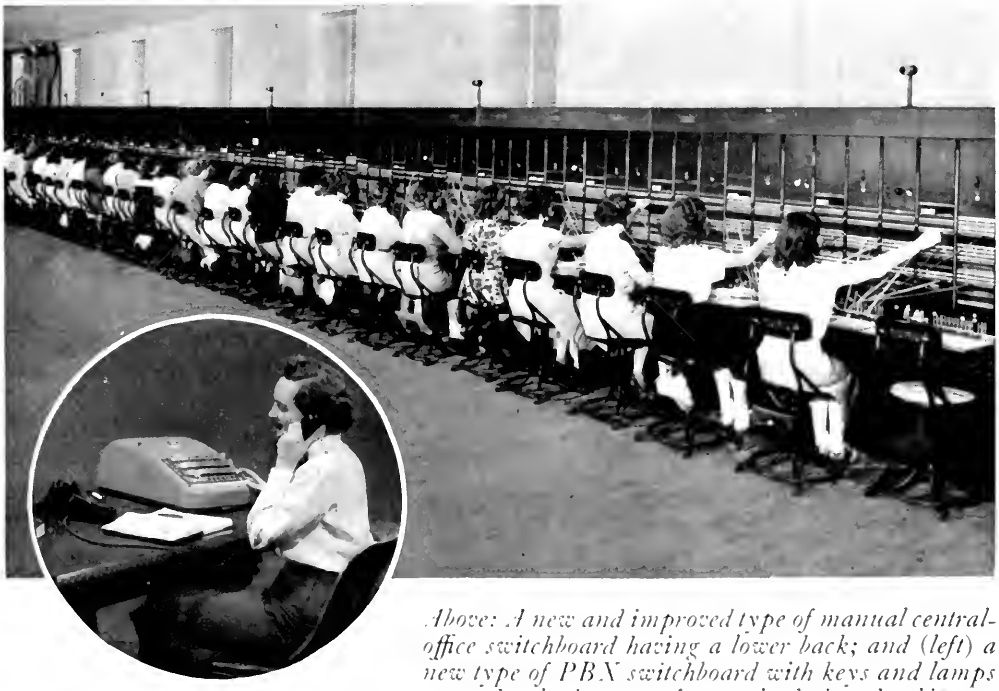
With the rapid growth of dial switching and decentralization of toll switchboards, fewer jacks and lamps are needed, and it has been possible to design a new switchboard * with a lower back. A way was found to accommodate the cords and weights in less space than formerly, thus resulting in a key shelf of conventional height for office furniture, such as tables and desks, and eliminating the need for either an awkward platform or high chairs.

The new type of switchboard is more convenient for the operators, improves ventilation and lighting, and conforms better to modern taste in appearance, while at the same time providing space for every kind of equipment needed by toll or assistance operators.

A new operating desk † has also been designed to handle such auxiliary services as the quotation of charges, the furnishing of routing information to operators, and information and intercept service to the public. Calls for these services are set up through switching equipment of the common control type, which assures that all are handled as promptly

* Coded 3CL Switchboard.

† Coded Operating Room Desk No. 23.



Above: A new and improved type of manual central-office switchboard having a lower back; and (left) a new type of PBX switchboard with keys and lamps on the sloping top of a newly designed cabinet as possible and at the same time automatically gives preference to the more urgent services. This desk also has its working surfaces at normal desk height, and is styled in the modern manner.

Another development, which is used by our customers rather than in our own operating rooms, should be mentioned at this point, since it also is in keeping with the trend toward modern design of office furniture. Two new cordless PBXs have been designed, and became available during 1951. One * provides for seven lines and three trunks; the other † for twelve lines and five trunks. They are housed in cabinets which not only are more pleasing in appearance than their predecessors, but also have keys and lamps arranged on a sloping top where they are easy to see and use.

Wire

WIRE is a simple thing; yet even in this homely and seemingly unpromising area, important advances have been made. Three examples will be sufficient for purposes of illustration.

"Drop wire," which is used to make the connection between a telephone pole and a customer's house, was formerly covered with a rubber compound, then by a braided cotton covering treated with asphalt and wax to protect it from weather and from abrasion by tree branches. This cotton jacket has been replaced by a much tougher one, made from a compound of neoprene, one of the artificial rubbers that became available during the war.

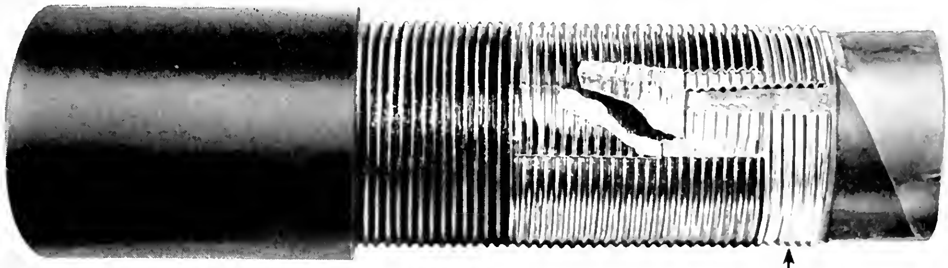
This new drop wire was first put into commercial production in 1945, and only reached full-scale production in 1948, but already enough has been produced to equip more than half of the drop-wire installations in the country! It is too early to assess the full measure of improvement which it will bring, but the new covering is much more rugged than the old, and a marked reduction in drop-wire troubles throughout the nation is already apparent.

The second example is the familiar insulated wire used inside the subscribers' premises, often tacked to moldings and painted over when walls and woodwork are decorated. Formerly, this consisted of two or more wires, separately insulated with rubber and cotton, twisted together, and attached by means of large-headed tacks. The new kind has all the wires enclosed in a single smooth plastic sheath, and it is fastened by staples instead of tacks. It looks better, wears better, is waterproof, and is easy to paint. It was introduced in 1949 and is now the standard for all station wiring.

Even the bare wire used in building rural lines has been improved by making it stronger. The strongest formerly available could not be used on poles more than 400 feet apart. Two kinds have now been provided that safely stretch across a full 600 feet. Both are of steel, one being of larger size where greater conductivity is required. Where higher conductivity is needed, a third form, consisting of a steel core covered by a copper shell, has been provided for use in spans up to 350 feet in average length.

All these wires are so resilient that, after being loaded down with sleet so heavy that they sag all the way to

* Coded 507A PBX.
† Coded 507B PBX.



"Cut-away" view of "stalpeth" cable, showing different types of protective materials

the ground, they usually do not break, but return almost to their normal positions when the sleet melts off.

Cable

CABLES are the thoroughfares along which the nation's messages travel. For fifty years or more they have consisted of bundles of paper-covered wires inside a sheath of lead. Lead seemed to be the only material with all the necessary properties: water-tightness, resistance to corrosion, bendability, and ease of manufacture. But the supply was sometimes limited.

In the '30s the Laboratories constructed some samples of cables with the lead replaced by a compound jacket, each layer of which provided some of the needed characteristics. These were under outdoor test throughout the war, and gave a good account of themselves.

The pent-up demand for telephones at the end of the war was such as to require unprecedented quantities of cable. But there was also a pent-up demand for paint and automobile batteries and other things in which lead was a primary material, and not enough lead to go around. If the telephone demand was to be met, some substitute would have to be found. It was natural to seek the answer in the composite cables which had been under test.

Fortunately, the chemical industry had in the meantime produced a remarkable new plastic material called polyethylene, and had demonstrated the feasibility of manufacturing it in large quantities. It was tough, waterproof, and an excellent dielectric. It was easy to fabricate and had the characteristics necessary for long life.

Practical experience in fabricating polyethylene was very limited; but through research in polymer chemistry, which is one of the continuing activities at Bell Laboratories, we had acquired an understanding of the problems that would have to be solved. A new kind of cable sheath was speedily evolved which could be put into production promptly, since it required neither critical materials nor much special machinery. It consisted of a jacket of polyethylene outside a thin layer of corrugated aluminum, the two being bonded together by a sticky compound.

This aluminum polyethylene, or *alpeth,* cable was put in production in 1947. By the end of 1950, alpeth cables containing about 10 million miles of wire were already installed in the telephone plant.

Few things are so good that further improvement is not possible, and the original alpeth cable was not one of them. Two improvements in particular have been made.

One was in the polyethylene itself, to overcome a serious tendency of the sheath to crack under some conditions to which it was subjected in practice. The phenomenon was quite a mystery when first observed; it was due to changes in the polyethylene brought about in a way not previously known to chemistry. Through research, however, the explanation of these changes was discovered, and also the fact that they could be prevented by using polyethylene of higher molecular weight, and by avoiding the use of soapy water when testing to detect leaks.

The other improvement was the addition, over the aluminum, of a thin tube of terne plate with a soldered seam. This makes the watertightness of the cable doubly sure, and costs no more, since the thickness of the polyethylene jacket can be materially reduced. Cable constructed in this way is known as *stalpeth.*

Other uses of polyethylene in cable include jacketing lead cables with a layer of the plastic for protection against corrosion in some underground environments; application of a layer over the core and under the outer lead sheath to provide lightning protection for cables to be buried in the ground; and conductor insulation on small aerial cables which are used in rural areas where lightning exposure may be severe.

Making Cable Construction Simpler

Cables are usually installed on overhead poles by first attaching the supporting strand to the poles, then suspending the cable from it in temporary supports, and finally lashing the strand and cable together with a wire. This process has been greatly simplified through the development of equipment which lashes the cable and strand together as they unwind from their reels.

In using this equipment, the reels are placed at one end of a line of poles, and a winch at the other, and the pre-lashed cable is pulled into place by the winch. The equipment is designed to maintain proper tension in both strand and cable at all times, and to prevent them from winding around each other. The new method has already been used in the field, and has been found to require much less effort than previous methods.

Pre-lashing equipment has not so far been designed to handle the largest sizes of cables, but the present pre-lasher can take care of at least 75 per cent of all aerial cable installations.

Other improvements in cable construction are achieved by new types of cable terminals having electrical protection built into the same blocks which contain the terminal binding posts, and a new type of mechanical splice closure at present under development. The latter promises to simplify the splice-covering operation and to give ready access to working splices in the plant.

Science

With the help of a newly developed device, cable can now be lashed to its supporting strand before the line is placed in position on the poles

THE LABORATORIES exists for the purpose of applying the best in science and technology to the improvement of communications, and all of its activities ultimately have that end in view. An important part of the job is exploring the frontiers of knowledge for new ideas, new materials, and a better understanding of the old ones.

In this exploration, we not only learn much from the work of others; from time to time we also contribute significantly to the advancement of science. There have been several important instances of this kind in recent years which deserve special mention.

One is Information Theory, which began as a mathematical and philosophical study of the useful content of the messages we transmit, and of the power and band width required to transmit this useful content. It is already playing an important role in some of our more forward-looking projects. It has many ramifications, however, and is having a profound influence upon the thinking of scholars throughout the world in such diverse fields as biophysics, philosophy, and epistemology.

The subject has aroused so much interest, in fact, that scholars from many countries convened in England during the summer of 1950 in a conference devoted to this subject alone. A member of the Laboratories presented an important paper at this meeting, and other Laboratories people have made valuable contributions in this field.

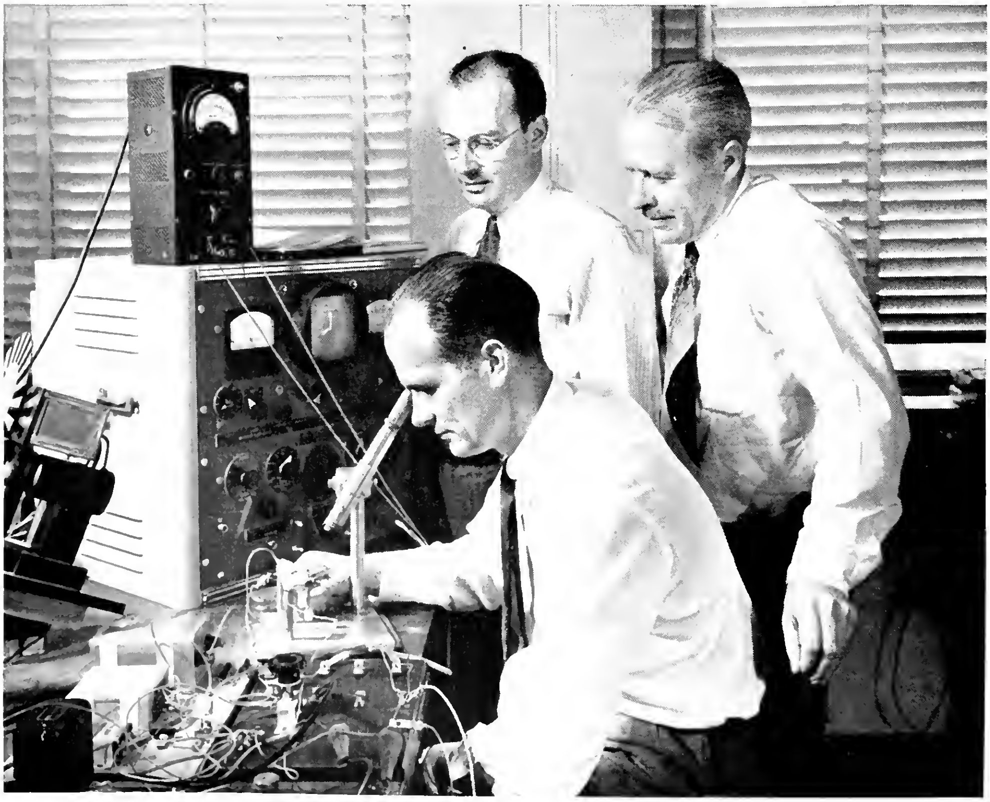
Semi-conductors—that is, materials with properties intermediate between metals and insulators—have constituted another important field of research. Here major contributions to scientific knowledge have been made on both the experimental and the theoretical sides.

The possibilities for useful applications are also spectacular, for out of this research have come several devices that will without doubt play a major role in the telephone equipment developed during the next decade. One is the transistor, which can do many things that are now done by vacuum tubes, but which requires neither a vacuum nor a hot filament, and consumes substantially no power except when it is doing useful work. Another is the photo-transistor, a device which converts light signals into currents in much the same way as photoelectric cells do, but is more stable than photocells, and better adapted to many circuit uses.

These are among the most important contributions to the art of communication which have yet come from the Laboratories.

In the field of chemistry, the Laboratories published a study early in the post-war period which showed that a belief widely held among chemists on theoretical grounds was incorrect. It had to do with the process by which certain liquids "set up" in a mold and produce solid plastics. Some of these were splendid insulators to begin with, but gradually deteriorated by oxidation. This seemed unavoidable, since theory said that substances which were hard to oxidize would not set up. The Laboratories' study showed that this was not the case: that the process could be carried out with substances which were almost immune to chemical attack by oxygen.

The response of the chemical industry was prompt. It is now manu-



In this laboratory was developed the transistor, a new type of solid electronic amplifier of revolutionary importance facturing—and we are using—chemicals that set up into insulators which retain their excellence indefinitely.

Not all new knowledge has such immediate application. It has been known for many years that at exceedingly low temperatures many metals become almost perfect conductors. The change is not gradual, it takes place abruptly within a small fraction of a degree. This phenomenon has been one of the mysteries of science, and many physicists believe that an adequate understanding of it will unlock the door to important advances in their science. Quite recently a most important advance has been made by one of our mathematical physicists.

It would be difficult to suggest how a phenomenon that occurs at a temperature several hundreds of degrees below zero can be put to use in telephony; but in view of the fact that our art is built on the conduction of electrical currents, anything which improves our knowledge of it is likely to be of interest in unexpected ways.

There Is Still Tomorrow

Early in the present century, the view was held by many that the great discoveries in science had been made and that scientific progress henceforth would be principally in matters of detail. This view could not have been more wrong. Within a few years Einstein published the theory of relativity, and before long we had the quantum theory and a long line of new discoveries.

When impressed by the importance of things just done, one can make such mistakes. One could do so in looking at the recent advances in telephony. Though the play has not yet begun, the stage is almost ready for universal subscriber dialing, for unlimited growth of long-distance service, and for nation-wide television. Is this the end? What is there left to do?

I am not so reckless as to attempt a forecast. I can no more see what lies beyond the horizon than scientists of fifty years ago could foresee nuclear physics and the atom bomb. But I can predict—and not on faith alone—that there are equally exciting and profitable days ahead.

There is the transistor, with all its unexploited possibilities.

There are laboratory glimpses, still not practical but surely prophetic, of dial systems that do not need rooms full of clicking relays.

Chemistry, for all its triumphs, is still a virile science from which even more amazing materials will be forthcoming.

And all human experience testifies that the unsuspected will also occur.

Great as have been the accomplishments of my associates in the Laboratories during the past decade, I am sure that some day even better things will come, and these developments which I have reported will take their place with other accomplishments of the past that looked just as great in their time and now are obsolete.

The Reliability of Bell System Plant at Times of Disaster

In recent months Harold S. Osborne, Chief Engineer, A. T. & T. Co., has discussed the use of telephone facilities at times of disaster with the Federal Civil Defense Administration and other government bodies. Below is a summary of his notes on those discussions.

The Telephone Companies, Bell and Independent, together blanket the entire United States with a network of interconnecting telephone circuits.

There are in service 44 million telephones, 135 million miles of wire in cities and towns, 30 million miles of intercity telephone circuits.

The telephone plant is so constructed that in general it is expected to survive a bombing very well in comparison with other structures.

Cities are underlaid with a close network of underground telephone cables with great numbers of pairs of wires which would generally not be destroyed by an atomic bombing.

Most telephone buildings in cities are of unusually strong construction and are expected generally to survive bombing better than the surrounding buildings.

Special arrangements have been made and others are now being made to minimize the likelihood of interruption of essential services in times of disaster.

Switching of essential lines will be protected to the same degree as people in shelters.

Auxiliary power insures against interruption because of shutdown of commercial power.

Arrangements have been provided to insure adequate capacity to handle calls from essential lines.

Duplicate outlets can readily be arranged for important points to the extent desired.

The mobile radio stations of the telephone system, protected by alternative transmitting and receiving points, can be used for immediate temporary service where needed. A large number of other emergency radiotelephone stations form a part of the telephone systems provision against interruption.

Telephone Companies have a very large reservoir of trained men skilled in all parts of plant work and used to quick action in emergencies.

Large stocks of materials are available to these men scattered throughout a very large number of locations.

The Telephone Companies as a part of their regular service provision have restoral plans providing for the prompt restoration of essential lines in time of disaster and the rapid restoration of all service.

The network of intercity circuits has great flexibility to provide rerouting to maintain essential services in the event of destruction of certain sections of intercity routes.

Extensive traffic control organizations throughout the country are continually at work readjusting the routing of traffic to take care of local peak demands and emergencies.

For all these reasons, the telephone networks form the best basis for meeting the communication requirements for civil defense, either within a city or country-wide.

If in certain situations additional facilities beyond those now available appear to be needed, they will be most effectively used if they are associated with the present telephone system and thus have the advantage of the flexibility of interconnection and the responsibility of the large construction, maintenance, and operating forces of the Telephone Companies.

Individual Recognition, Steady Employment, Good Pay, Variety of Job Opportunities—These Are Some of the Reasons So Many People Choose Telephone Careers

The Telephone Company As a Place to Work

J. N. Stanbery

It is a well-known fact that the Telephone Company is an important employer in most communities of any size. But the public is more likely to think of it as a big company in terms of invested capital—or of assets in the form of buildings and switchboards and pole lines and all the other material things required to serve millions of customers.

Important as these things are, it's the human element—people—more than anything else that has enabled the business to attain its present high level of efficient performance. For without human ingenuity and skill, even the finest precision apparatus could not create a smoothly-functioning telephone system.

The Telephone Company's position as an employer imposes on its management many responsibilities. The fundamental personnel policies that guide the management in its approach to such problems as wages, working conditions, promotions and pensions underlie the company's reputation as a good employer, and—of equal importance—its ability to continue to attract the kind of people it must have. It takes a long time for any organization to build a good reputation as an employer, and the Telephone Company has been no exception. Its personnel policies and practices in force today are the fruit of years of experience.

A good measuring stick of an organization's standing in the community as an employer is the number of job applications it receives in relation to the size of its working force, or the proportion of applicants accepted. In 1951 there were an estimated 39,900 applications for operators' jobs alone in the Illinois Bell Telephone Company. Of that total 7,600, or about one out of five, were employed.

A sizable proportion of the men

and women who seek telephone jobs are people who are referred by present or former employees of the Company. Telephone people's eagerness to have their friends work for the Company contributes to the prestige of telephone jobs. Employment-office personnel say that telephone people are the most potent single source of applicants from a *qualitative* as well as quantitative standpoint. That source produces a greater proportion of acceptable applicants than any other, and on the average they remain with the Company longer.

Present and former employees are also a powerful *indirect* factor in attracting applicants. When asked what prompted them to seek telephone work, many say they know people who work—or who once worked—for the Telephone Company, and that those people spoke well of their jobs and the Company.

A good illustration of the influence of this indirect factor was the experience of men's employment-office interviewers during the post-war period, when millions of young men discharged from military service were eager to get started on their first job or to resume a working career interrupted by the war. Many in the latter group were men in their twenties, their outlook broadened by travel and military experience, and young enough to regard their pre-war jobs as not necessarily permanent.

One question asked of ex-service men who came to telephone employment offices was, "Why do you want to work for the Telephone Company?" Their answers varied, but an explanation frequently given ran something like this: "While in the service, I did a lot of thinking about the kind of work I'd like to get into after the war. So did the other fellows. Naturally, we talked about our jobs and the companies we worked for. Some of the fellows in my outfit were telephone men. One thing that stuck in my mind was that these men, without exception, seemed to like their jobs and the company they worked for. And every one of them intended to go back to the Telephone Company. The more I thought about it, the more I convinced myself that I should try to get into telephone work."

The fact is, of course, that upwards of 97 percent of the Illinois Bell men who were granted military leaves during the war period, and who left military service, returned to their former or better jobs.

What the Telephone Company Offers

What an organization can offer ambitious young people in the way of possibilities for ultimate partnership or ownership of the business is sometimes a major factor in the planning of their careers. For those who feel they have the necessary potentials, this desire to get into a business they might conceivably some day own or control is frequently the driving force that impels them to choose one company over another.

Obviously no business like a telephone company could offer that kind of inducement. Nor can telephone work promise the large returns sometimes gained by men employed in highly competitive, new, or speculative enterprises—for the policy under which the Company operates precludes the earning of large or speculative profits.

There are, however, many offsetting advantages that make telephone work attractive to the career-minded individual. For those who make good, there is opportunity for steady progress, and the chance to realize over a period of years on the experience gained each year.

The business is so big, and its operations so varied, there are opportunities in it for individuals of many types of skill and interest. There is wide variety in the types of work related directly to the performance of the day-to-day telephone service job—such as engineering, business office positions, sales, plant construction, installation, maintenance, traffic operating, and accounting.

In contrast to its size, a company like Illinois Bell Telephone Company is for the most part decentralized, and this decentralization carries through to all organizational levels. At the local or community level, management functions pretty much "on its own," with no more direction from above than prudent over-all administration calls for.

Quite often this "working on one's own" extends all the way down the line. To cite an example: The telephone installer, as he makes his rounds, is pretty much his own boss. He has his own truck, his own tools. No two installations are quite alike. Each telephone he puts in not only must fit perfectly into the local exchange system, complex in itself, but

Good pay, steady employment, job prestige, the opportunity to work with congenial associates of their own age— these are some of the reasons why telephone work appeals to so many young women

In its day-to-day operations, the telephone business requires close coordination of effort within departments and between departments. Whatever the problem, the solution is arrived at through a pooling of ideas, with each individual concerned participating in the decision

must be capable of interconnection with any other telephone—in the next town, across the country, or beyond the ocean. So, though he performs as an individual, the installer is at the same time a member of an installation team, who builds good public relations for his Company.

Importance of Teamwork

THE TELEPHONE BUSINESS differs from most other businesses in several important respects. It is a monopoly by its very nature. It is a highly technical business. It is strictly a retail, not a wholesale, business. It is a tailor-made, not a mass-production, business: every call is set up individually, no two calls are exactly alike, and you can't manufacture them in advance and store them up on a shelf. It touches intimately the life of practically everybody.

Such factors as these make imperative the existence of what is perhaps the most distinguishing characteristic of telephone work—the "working together" atmosphere that pervades every operation. In the telephone business the smaller "team" does the many separate jobs, and yet the employees of all telephone companies work together to make a team to provide nation-wide the world's best telephone service.

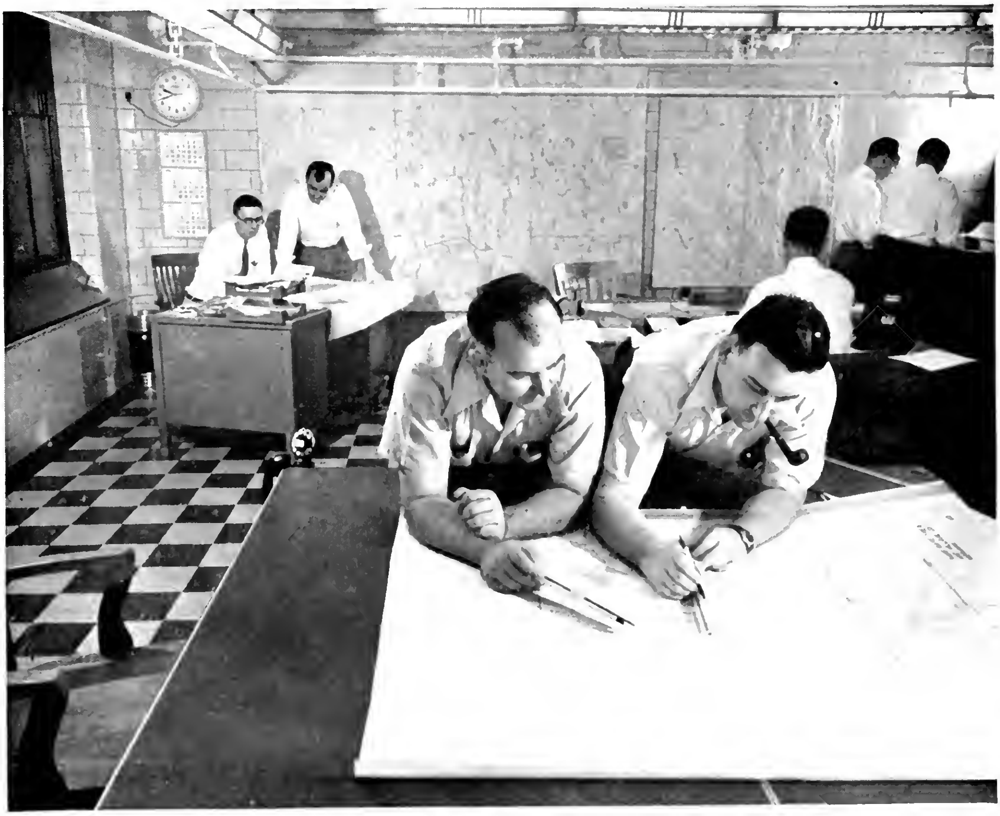
You would have to look far to find a better illustration of teamwork in action than the operating room of any central office, for there you would see many people working side by side to keep the steady flow of calls going through smoothly, quietly, and without interruption. That kind of teamwork characterizes the activities of every group in every department. Whatever the problem—and there are many in the day-to-day operation of the business—the answer is always determined by what is best in the interest of good telephone service.

Not that the individual, in exercising his responsibility, is hamstrung by lack of authority to act effectively. But in a closely-knit organization where the act of an individual or group within one department may affect those in other departments, the approach to a specific problem must be broad enough to fit the needs of the over-all service job.

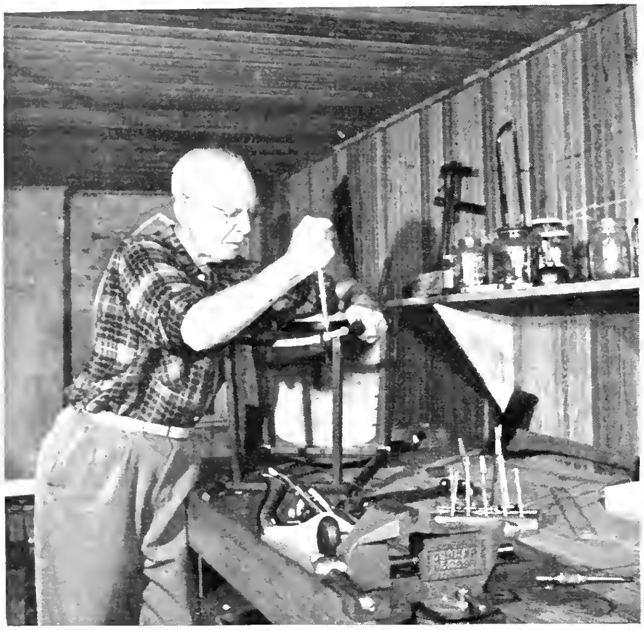
Even at the highest levels, this technique prevails. Particularly in matters requiring major policy decisions, changes in procedure, or introduction of new methods, the course of action is determined not by arbitrary directive but through a pooling of ideas, with each individual concerned participating in the decision.

Teamwork and the Individual

This "working together" process enables the individual to express his own creative and productive talents. It gives him the opportunity—and incentive—to contribute new ideas, and to play his part in the development of new concepts in the business.



The orderly teamwork techniques that enable the Bell System to care adequately for the needs of its customers provide employees with opportunities to develop their abilities, improve their skills, and grow with the organization



The Bell System's Pension Plan helps make it possible for telephone people to enjoy their later years in comfort and security

Specialists in the fields of industrial management and personnel administration stress the importance of the individual, and the fact that only the individual can think, or do the work that has to be done. In organizing and directing the efforts of individuals, Telephone Company managements utilize an orderly and effective team process by which the service needs of millions of customers can be cared for. The same process gives the individual opportunities to develop his abilities, improve his skills, and grow with the organization.

All in management jobs are telephone people, at different stages of their careers. They are the individuals who have come up through the ranks under the long-term policy of "promotion from within." There is nothing unique about this policy, but in probably no other industry is it applied more consistently. If you were to take an organization chart of the Illinois Bell Telephone Company, or of one of its departments, and look up the service record of each person shown thereon, you would find a succession of jobs that led to his present place on the chart.

Plenty of Promotional Opportunities

A STUDY made about two years ago turned up some remarkable facts about promotional opportunities in the Illinois Bell, on a quantitative basis.

Organizational Level	*Approximate Number of Employees*	*Per Cent to Non-Supervisory Employees*
Non-supervisory employees	35,055	—
First line supervisors	2,900	8.3
Second line supervisors	975	2.8
District level and equivalent	550	1.6
Division level and above	110	0.3
Total number of employees	39,590	
Per cent supervisory to non-supervisory		13.0

The table shows that there is an average of one supervisory employee for every 7.7 non-supervisory employees. However, a non-supervisory employee's chances for promotion are greater than that ratio indicates. Because when a position becomes available at the second supervisory level there are generally two promotions: one from first to second supervisory level, and one from non-supervisory to supervisory level. Openings at higher levels create corresponding increases in the number of promotional opportunities. The following table gives a broader picture:

Promotional Opportunities

First line supervisors	(2,900 x 1)	2,900
Second line supervisors	(975 x 2)	1,950
District level and equivalent	(550 x 3)	1,650
Division level and above	(110 x 4)	440
Total number of promotional opportunities		6,940

The picture is still incomplete, because the tables exclude all promotional opportunities below the first line supervisory level, and do not reflect opportunities for promotion within an organizational level. For example, several promotional steps invariably precede an employee's advancement into a first-line supervisory job, and inclusion of these chances for promotion within the non-supervisory category would alone increase the total of promotional opportunities to as much as four or five times the 6,940 figure. In addition to the opportunities cited, each individual wage increase, scheduled or merit, is in recognition of the employee's continued development and is supplemental to promotional opportunities.

A check of the Company's supervisory service records showed that in 1950 there had been a combined total of 2,668 promotions—representing 6.7 percent of the total average number of employees on the payroll that year. There were 1,025 promotions of men, or 7.6 for every 100 employed, and 1,643 promotions of women, or 6.3 for every 100 employed.

Job Security

Job security still rates high on the list of standards by which any job is judged. Few if any jobs offer complete security—and that's a good thing. A life-term convict enjoys complete security of a sort—but at what cost of personal freedom and self-respect! It's only natural for a person to regard his job not merely as a means of satisfying his immediate needs, but as a continuing source from which he can derive personal and emotional satisfactions

Whether their office is small or large, telephone people can enjoy "a pause in the day's occupation" in cheerful, homey surroundings. The larger offices are equipped wtih modern cafeterias as well as the material comforts of life.

THE Company's good record in this matter of job security didn't just happen. Rather, it's been the result of careful planning and a consciousness on management's part of the importance of the human factor in its approach to problems that affect the lives of large groups of people. Job security with Illinois Bell starts with the fact that the Company is a growing, progressive business. The ever-improving quality of telephone service over the years has led the public to look for continuous betterment and expansion. Each advance plants the seeds of the next.

Except for three depression years, each year of the Company's existence has seen an increase in telephones over the previous year. The continuous nature of the service—which the public has grown to expect on a 24-hour, 365-day basis in good times and bad—means that the business is relatively free from the ordinary fluctuations in employment that occur.

Not that this Company is immune from the ups and downs of the business cycle. Seasonal loads fluctuate, in some departments more than others. In traffic work there are daily and hourly changes, some predictable, others not—but when disaster, severe weather, or sensational news breaks cause sudden peaks, operating forces must be ready to cope with them.

In the introduction of technological improvements—dial conversion programs are the best example—management ingenuity and long-range planning minimize the immediate effect on employment. In her book, "People at Work," Frances Perkins, former U. S. Secretary of Labor, described the manual-to-dial program as "an almost perfect example of technological change made with a minimum of disaster," accomplished "through human as well as technical planning."

U. S. Bureau of Labor Statistics reports beginning in 1943 show that monthly turnover in the telephone industry averaged less than half the rate for all manufacturing industries. Over the ensuing period, "quits" averaged only a little more than half as high in the telephone industry, "discharges" one-fifth to one-fourth as high, and "layoffs" about one-tenth as high as for manufacturing industries as a whole. These figures also reflect the higher turnover among the industry's women employees, of which there are more proportionately than in most industrial categories.

An abnormally high influx of new people has swelled the Illinois Bell ranks in the last few years—yet the most recent employee census showed the average length of service to be 14.7 years for men, 9.9 years for women. Almost 39 percent of the men and 22 percent of the women had 20 or more years of service. Studies have shown that, excluding deaths, three out of four men and three out of ten women who stay in the service over five years remain until retirement on pension.

Other Factors That Make for Job Security

ALONG WITH job *permanency*, such factors as wages and the so-called "fringe" benefits contribute to job *security.* Employed people want to earn enough to enable them to live in reasonable comfort, take care of their families, educate their children, provide for emergencies such as sickness and accident, and care for old age.

At the same time, they wish to enjoy their work, to feel that it is useful, to do it well and to take pride in it, to have their efforts appreciated and abilities recognized, and to have pleasant relations with their fellow workers and their employers.

Personnel practices of the Illinois Bell Telephone Company are directed toward making it possible for telephone people to achieve those objectives. The management recognizes that its best assurance of getting and keeping high quality people is to pay wages that compare favorably with those paid by other employers in the community for work requiring similar skill and training.

Good wages and continuous employment make it possible for telephone people to set aside part of their earnings for emergencies, old age, and other purposes. Thrift plans under which employees may authorize regular allotments from pay make it easier for them to do this. Under these plans, Illinois Bell employees in 1950 laid aside $11,700,000, or 8 percent of the payroll, for purchase of U. S. Savings Bonds and A. T. and T. stock, and for life insurance premiums, hospital and surgical care programs, and deposits in savings institutions.

Benefits and Pensions

Every Illinois Bell employee is protected by the Company's Benefit and Pension Plan. This Plan is recognized as among the best and soundest in American industry. Established in 1913 after a thorough study of the principles and expenses involved, it has been amended from time to time to extend its benefits and strengthen its provisions.

The cost of the Plan is borne entirely by the Company. Service pen-

No matter what the emergency, telephone people traditionally take it in stride. This thought of "service first" is more than devotion to an organization; it comes from a sense of individual responsibility in the public service sions are paid from a Pension Trust Fund accrued in advance on an actuarial basis, and this fund, which currently totals over $93,000,000, can be used only for service pension purposes.

By and large, telephone work is one of the safest of occupations; the industry's accident frequency rate is the lowest of the 40 industries which report such data to the National Safety Council. It has not, of course, been possible to remove all the hazards, but the Company's safety creed is that "no job is so important, and no service so urgent, that we cannot take time to perform our work safely." In the design of tools and materials, and in work procedures, safety gets major consideration. Through competent supervision, job analyses and first aid training, safety-consciousness is implanted in the minds of employees.

If a worker *should* get hurt on the job, the Benefit Plan of his Company provides full pay up to a year, and half pay after that—the periods of payment depending on length of service, and on whether the disability is partial or total. For sickness or off-the-job injury, the Plan pays up to a year's wages, depending on length of service. Sickness death benefits to an employee's dependents range up to one year's pay, depending on length of service.

Telephone people enjoy playing together as well as working together. Organized athletic, social, and cultural activities sponsored by employee groups offer Bell System men and women opportunities to cultivate a wide variety of leisure-time interests

How the Pension Plan Works

Employees with 20 or more years of service may retire on service pension after reaching age 60 in the case of men and age 55 for women. Under a long-standing provision, employees are required to retire at 65. The systematic retirement plan helps the business to maintain an employee body with sustained vitality. As older people retire, job opportunities are created and the way to advancement is opened to younger employees.

The amount of annual pension is determined by taking the number of years of the employee's service in Bell System Companies as a percentage, and multiplying this by his average annual pay for the 10 years preceding retirement. When eligible for Social Security benefits, this amount of pension includes the one-half of such benefits attributable to taxes paid by the company. The employee also receives Social Security benefits attributable to taxes paid by him. Minimum pension for full-time employees who qualify under the Plan is \$75 a month up to age 65, and after 65, \$100 a month, including Social Security payments. Disability pensions may be payable at any age after 15 years' service.

The work of these long distance operators illustrates the importance of telephone people's contribution to the nation's well-being. Through their overseas switchboard goes a constant stream of Government, business, and social calls, making neighbors of nations

At the end of November 1951, there were 1,179 men and 1,262 women on the Illinois Bell Telephone Company's service pension rolls, and 1,500 more employees had been credited with enough service and had attained the age which entitled them to retire on pension at their own request.

"Intangibles" That Contribute to Job Satisfaction

Job satisfaction comes from many things besides those which make for job security. Good working conditions, friendly associates, pride in the job and the Company, a sense of participation in a worth-while activity—these are some of the "intangible" aspects of telephone work that help to make it attractive. Their relative importance may vary with individuals.

Because of the telephone's universality and social usefulness, people in the business have a genuine feeling of pride in being part of it—and a sense of the importance of their contribution to the community's and nation's well-being. In times of emergency, this sense of "belonging," this "spirit of service," manifests itself in employees' willingness to disregard their own comfort and work long hours under trying conditions.

The Illinois Bell Company, both as a corporate "person" and through its employees, tries to be a good and useful citizen. Because the "Spirit of Service" is so much a part of their everyday job, telephone people are conscious of their responsibility to the community in which they live, and can always be counted on to support worth-while community projects. Under present conditions, Civil Defense is one of the most important community projects. Telephone people are in the midst of this. The first aid training programs are an integral part of it, and many employees have assumed a variety of other Civil Defense duties in their own communities.

In perhaps no other industry is there greater opportunity for individuals to work together in a helpful, congenial atmosphere. The multiplicity of father-son, mother-daughter, and other family combinations makes telephone work a family affair. In few other occupations do you find so many sister pairs and mother-daughter teams in the same office.

Clean, comfortable working quarters are a "must" with the telephone companies, and traditionally the trend has been toward more quiet and cheerful surroundings, tastefully decorated lounges, and improved cafeterias serving good food at moderate prices.

In the larger cities, many employees may have the choice of working at locations close to home. Around-the-clock functioning of the telephone system provides a degree of flexibility in central-office working hours. Some employees—because of home responsibilities, school or college attendance, or for other reasons—can choose hours other than those considered a standard business day.

Telephone people like to play together as well as work together. You could scarcely name a single leisure-time group activity that isn't

Almost every day, some act is recorded which exemplifies the loyalty and devotion of telephone men and women. Some of these meritorious deeds and services are so outstanding as to deserve enduring recognition. Vail Medal Awards were created to give this indulged in somewhere by telephone people. A recent survey revealed more than 70 recreational activities under way.

What of the Future?

Seventy-five years ago one man's vision and creative efforts brought into being a new industry. His idea transformed the whole pattern of living. Since that historic evening in Boston when the telephone carried its first intelligible sentence, the telephone industry has never stood still —because down through the years other men of vision and energy have contributed new ideas, new inventions, new techniques, until today America enjoys the finest telephone service in the world.

Every member of the telephone team can justly take pride in being associated with a vital, growing industry whose future is destined to transcend its past. For those who have the necessary capacity and willingness, the opportunities for useful service, for incentives and rewards, were never greater.

In a letter to the president of the organization, who had congratulated him on the occasion of his 40th service anniversary, a Plant Department man wrote:

"I have been increasingly thankful through the years that my business lifetime has been spent with and for the Telephone Company. It is a fine organization and together with my friends and associates in this and the associated companies, it has been a major factor in my happiness and security."

Countless others have found happiness and security in their telephone jobs. Future generations will follow in their footsteps, if you and I and our teammates keep the telephone company a good place to work.

New York-London Telephone Service Was Opened 25 Years Ago

From the BELL TELEPHONE QUARTERLY for January 1927

COMMERCIAL telephone service between New York and London, for years a goal of telephone scientists and engineers, became a reality on January 7th, 1927.

Announcements had been made both in New York and in London that applications for the use of the circuit would be received beginning Wednesday, January 5th, at 8:30 A.M. and that the order in which the applications were received would determine the assignment of the circuit after its formal opening. The annouced rate was $75 for three minutes.

The keen interest manifested in the service on both sides of the Atlantic was evidenced by the number of calls booked for the opening day, and when the circuit was closed down, a total of 31 trans-oceanic calls had been handled, including messages between banks, newspapers, business concerns, and individuals.

The New York ceremonies in connection with the opening of the service took place in the directors' room of the American Company's headquarters at 195 Broadway.

To the directors and officers of the Company who had been invited to attend the ceremonies, Mr. Gifford outlined the continuous research and experimentation that had brought to pass the realization of trans-Atlantic telephony. He then lifted the receiver of an ordinary desk-set and, with the guests listening through receivers especially installed at each chair, asked for a telephone connection with Sir G. Evelyn P. Murray, Secretary of the General Post Office of Great Britain. The call was completed in less than a minute and the historic conversation, over a circuit of wire and ether 7,190 miles in length between Bell System headquarters and the British General Post Office, began. Mr. Gifford's greeting was as follows:

"Today, as a result of very many years of research and experimentation, we open a telephonic channel of speech between New York and London. Thus, the people of these two great cities will be brought within speaking distance. Across three thousand miles of ocean, individuals in the two cities may, by telephone, exchange views and transact business instantly as though they were face to face. I know that it is your aim, as it is ours, to extend this service so that in the near future any one in either of our countries may talk to any one in the other.

"No one can foresee the ultimate significance of this latest achievement of science and organization. It will certainly facilitate business; it will be a social convenience and comfort; and, through the closer bond which it establishes, it will promote better understanding and strengthen the ties of friendship. Through the spoken word, aided by the personality of the voice, the people of New York and the people of London will become neighbors in a real sense, although separated by thousands of miles.

"We are glad to have coöperated with you in this notable enterprise and shall actively continue to work with you in extending and improving the service. I congratulate you upon your successful solution of your problems and wish to extend to you and to your associates the greetings and good wishes of the officers and staff of the American Telephone and Telegraph Company and of their associates in the Bell Telephone System."

Present Orderly Conversion Program Foresees Transition To Operator Toll Dialing Completed in Next Decade and Further Progress in Customer Toll Dialing

Toll Dialing Is Expanding Throughout the Nation

Ernest W. Baker

The following is from a talk before the Fifty-Fourth Annual Meeting of the United States Independent Telephone Association at Chicago on October 15, 1951. Before becoming Chief Engineer of the Western Area of the Bell Telephone Company of Pennsylvania on September 1, Mr. Baker had been Plant Extension Engineer of the A. T. & T. Co., and responsible for coördinating the nation-wide toll dialing project. EDITOR

TOLL DIALING is the method of operation by which a toll message originating at a calling telephone anywhere in the nation reaches the called telephone by the use of dial equipment.

With *Operator* Toll Dialing, the customer dials the usual code to reach the long distance operator at the originating point, and she completes the call by dialing the necessary codes and the called number. The operator receives signals to tell her when the called telephone answers or whether it is busy; also whether the toll circuits are busy. In short, the originating long distance operator receives all the details needed for completing the call and for proper billing.

With *Customer* Toll Dialing, the call is dialed to completion directly from the originating telephone, and all data required for billing are recorded in a mechanism designed for that purpose.

With both operator and customer toll dialing, provision is made to reach information and other operators if their assistance is needed in completion of the call.

Toll dialing has been in use on a sectional basis for many years. It started with an extension of the use of local dial equipment, and was expanded gradually as special switching arrangements and improved signaling systems made such expansion possible.

Development work had been in progress for some years before the start of World War II on a common-control toll switching system of the crossbar type, and the first installation of this new form of equipment was made in the latter part of 1943. This is the No. 4 toll crossbar system installed in Philadelphia.

One problem in the early stages of the work was to decide what were reasonable objectives for expansion of toll dialing as soon as the recovery from war conditions would permit. Experience with this method of operation in sectional networks gave promise of marked improvements in service and indicated that gradual mechanization of the toll plant would have other important advantages. These conditions led the Bell System, beginning about eight years ago, to formulate a basic plan which would guide the general extension of toll dialing to a nation-wide system.

Scope of Toll Dialing and Need for a Plan

The prospect confronting the telephone companies was the conversion of the entire toll plant to dial operation. This toll plant represents an investment of several billions of dollars. It reaches over the entire nation and includes many types of plant, each with its own peculiar problems but designed and coördinated to serve the needs of all toll traffic.

It was clear that expansion of toll dialing would involve unusual problems of coördination, since the conversion to dial would necessarily be made at various times and in all sections of the country. It was obvious that an undertaking of this magnitude deserved the guidance of a comprehensive plan, to insure that individual projects would be done in a way that would enable all to be tied together to form a highly integrated nation-wide system.

In setting out to develop a fundamental plan of this type, the basic objective was to provide a program for orderly conversion, on a sound financial basis, to one hundred per cent toll dialing with very rapid service on both direct and switched traffic. This was to be accomplished by:

1. Dialing calls to completion from point of origin, for both direct and multi-switch traffic;

2. Establishing connections between any two telephones quickly and with assurance of satisfactory transmission;

3. Doing the work at minimum cost consistent with the service objectives, and in a way that would employ operator toll dialing initially but would permit later expansion of customer dialing as it proved desirable —even to a nation-wide basis.

Broadly, the problem was to develop a plan which would assure early realization of a superior toll service to the public and which would lend itself to piecemeal but steady transition to the ultimate objectives.

It had to be economically sound, making effective use of the very large investment in existing toll plant. It had to enable an individual operating telephone company to develop toll dialing in a way that would adequately serve its own territory and at the same time function as an integral part of the over-all system. To serve the public properly, it had to be nation-wide in scope, including not only Bell System companies, but also Independent Companies to assure truly nationwide service.

Also, early discussions with Canadian representatives led to the conclusion that the plan should contemplate the inclusion of Canada in the toll dialing network.

Recognizing the need for industry-wide coöperation, meetings were held, at an early stage of the work, with a committee of the United States Independent Telephone Association to consider the over-all undertaking, with emphasis on problems relating to inter-company dialing.

As an outgrowth of these discussions, a statement was prepared which gave in general terms the essential requirements for equipment of any manufacturer to assure coördination with equipment provided by other companies elsewhere in the network. This statement was made available to the U.S.I.T.A. committee, and they disseminated the information among Independent Companies by publication in national magazines.

As the work progressed, similar memoranda on other phases of the plan were likewise furnished the U.S.I.T.A. committee and publicized by them. Of course, in addition to this there have been many discussions of toll dialing problems between Bell Operating Companies and their neighboring Independent Companies.

*Requirements for Nation-Wide Toll Dialing**

Expansion of toll dialing to a nation-wide basis involves many problems quite different from those arising in development of toll dialing only for a small area or for a single state. It is essential that the over-all plan contemplate additions of sectional networks as they are warranted, and that such networks be so designed that they can be merged with the growing nation-wide system.

NATIONAL NUMBERING PLAN

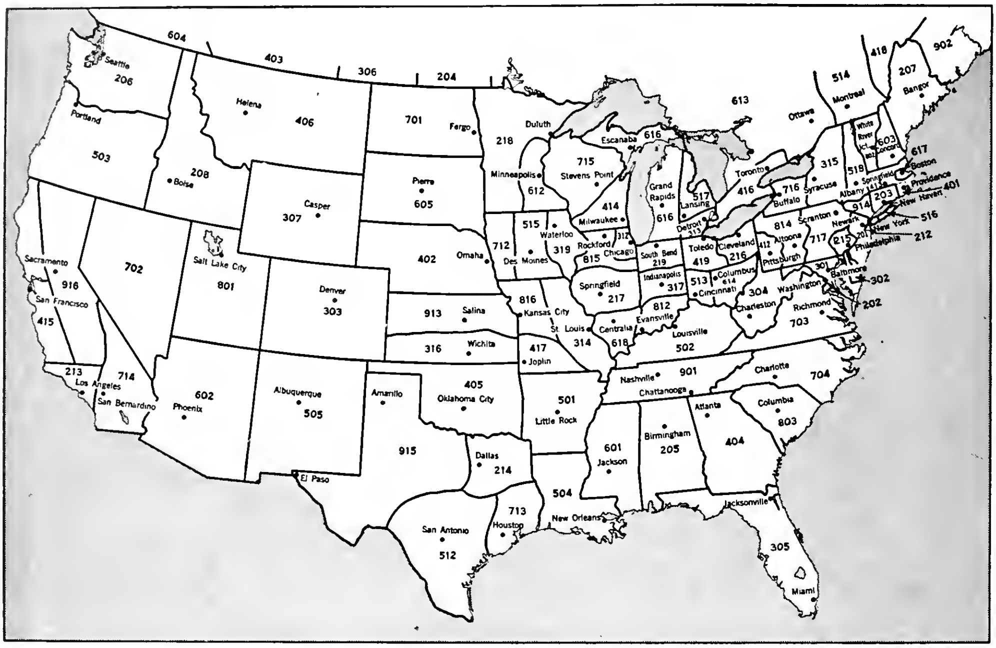
The long distance toll business of the country as a whole is handled at some 2600 toll centers which are connected together by a complex network of toll circuits. It is evident that for the most efficient operation of a toll dialing system throughout this large network, it is necessary to reduce to a minimum the routing information which the operator must use to set up the connection.

For toll dialing purposes, each customer in the United States and Canada will have a distinctive number not conflicting with that of any other customer. This will consist of his local number prefixed by some extra digits, as required, for toll routing purposes. The national number will normally consist of 10 digits and in a few cases 11 digits. In order to accomplish this, the United States and Canada are divided into 90 numbering areas, as shown in the chart on the next page.

GENERAL TOLL SWITCHING PLAN

This basic requirement of the nation-wide toll dialing system provides

* Limitations of space necessitate omission of Mr. Baker's detailed explanation of equipment arrangements which are common to both sectional and the nationwide toll dialing networks: Toll Switchboard Arranged for Dialing; Pulsing and Supervision System; Local Dial and Toll Dial Equipment at Terminating Points; and Basic Toll Circuit Network.



The United States and Canada are divided into 90 numbering areas

an orderly method of connecting together all of the elements involved. Every outward toll operator must have ready access to a control switching point to which she will deliver by dial or key equipment the number representing the destination of the call. The switching plan provides for complete interconnection of control switching points, either by direct circuits or by automatic switching, to assure routing a call from any place in the nation to any other place in a systematic manner and in a very short time.

A general toll switching plan has been in use throughout the country for more than twenty years with manual toll switching. Some changes are being made in the switching plan to adapt it to use for nation-wide toll dialing.

One purpose of a general toll switching plan is to set up certain over-all limitations on built-up connections to assure satisfactory transmission on the worst connection. It is expected that the limiting connection with the dial plan will have as good transmission as with the present routing plans. The continuing objective is to improve the grade of transmission.

SPECIAL EQUIPMENT AT IMPORTANT SWITCHING POINTS

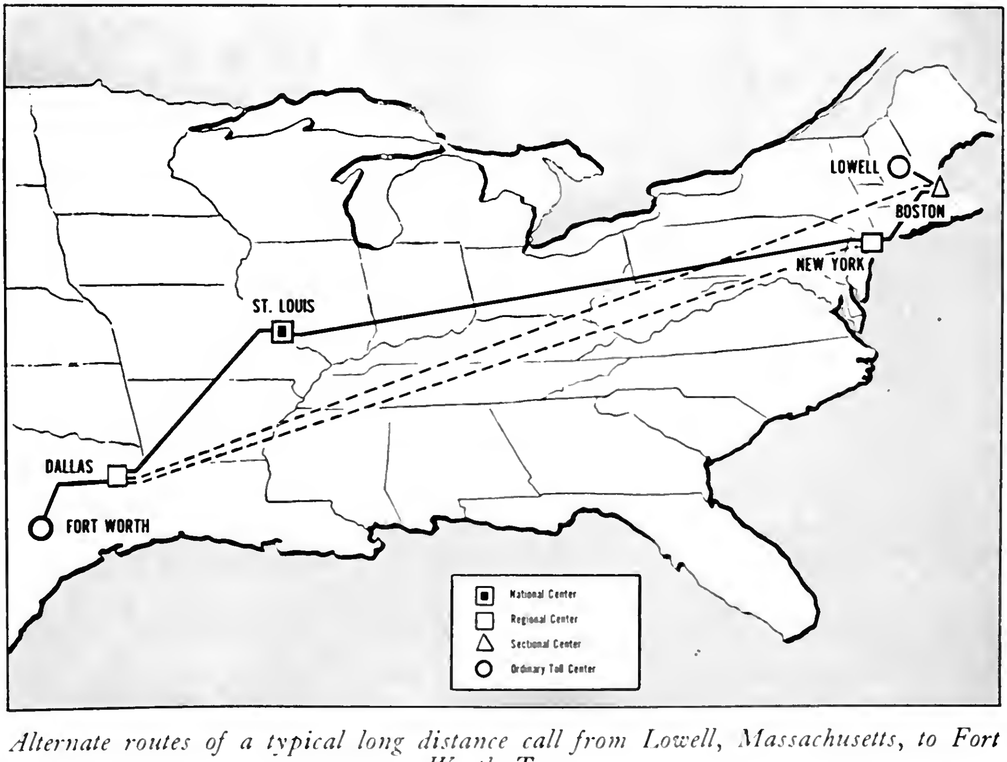
The dialing plan requires that rather complex switching systems be installed at relatively few toll centers which are the important "crossroads" of the nation-wide toll circuit network. These places will require common control equipment and will be called "Control Switching Points" (abbreviated CSP). The equipment used at CSPs is more costly than the simple step-by-step toll dialing equipment which is adequate for the great majority of toll centers. The dial switching equipment at a CSP is not merely a device to connect one toll circuit to another; it has the very important function of tying the individual sectional networks together so that collectively they constitute a smoothly functioning nation-wide system.

For satisfactory toll dialing, it is necessary to have the equipment determine the routing at the control switching points. The code assigned represents the destination of a call. The dial equipment interprets this code, selects the route, operates the switches at intermediate points, tries alternate routes if necessary, and completes the call to the distant telephone.

ROUTING OF A TYPICAL CALL

The routing of a typical call from Lowell, Massachusetts, to Fort Worth, Texas, ARlington 5–1234, is shown on the chart below.

The operator at Lowell would dial the code 915 AR 5–1234 over the Lowell-Boston circuit into the Boston toll crossbar switching system. The machine at Boston would first test all trunks to Dallas; and, if they were busy, would select a trunk in the final group to New York and send the call along to the toll crossbar system in New York. The machine there would first test all trunks to Dallas; and, if they were busy, would complete the call over the final groups to St. Louis and Dallas as indicated.



Alternate routes of a typical long distance call from Lowell, Massachusetts, to Fort Worth, Texas

Customer Toll Dialing

As stated earlier, one of the basic objectives in developing the nation-wide dialing plan was that it be suitable for nation-wide customer dialing to the extent that this might later become desirable.

Customer dialing is now in a state comparable to that of operator toll dialing about 1943. Customers are dialing short-haul toll and multi-unit calls very successfully in limited fields, concentrated particularly in metropolitan areas. In these areas, automatic ticketing, zone registration, and local automatic message accounting (AMA) are all in use for recording billing information.

Plans are being made for future extension of customer dialing, including the use of a centralized AMA arrangement now under development.

Extension of customer dialing to longer hauls involves all departments, and makes it essential to have very close coöperation throughout the telephone industry. It is important that the plant additions, new operating arrangements, and similar advances, all be in harmony with the long-term objectives for nation-wide customer dialing.

A few examples of the forward-looking planning that must be done are:

Dialing procedures for customers must be simple. Customers cannot be expected to do the things operators are trained, with careful instruction and supervision, to do. There is greater need for establishing uniform numbering plans and dialing methods as a part of the introduction of customer toll dialing.

Long-haul customer dialing requires dial number plates having both letters and figures. Replacement of station equipment with number-only dial plates might be avoided by planning in advance for use of number plates having both letters and figures where introduction of customer dialing is contemplated.

Methods are needed of encouraging customers to place a larger proportion of calls on a station-to-station basis. This will permit extending the service advantages of customer dialing to a larger portion of the traffic.

Customer Dialing Trials

Over a year ago, the dialing area of the customers in the automatic ticketing offices on the Peninsula south of San Francisco was extended to include Sacramento numbers in addition to the San Francisco metropolitan area numbers. This involves moderately long haul dialing and is working satisfactorily.

A full-scale test of customer toll dialing has been in operation since last November 10 * in Englewood, N. J., where 10,000 customers are able to dial direct to any of 11,000,000 telephones in certain cities from coast to coast and in larger areas nearby. Operation is on a completely automatic basis, just as it will ultimately be for all customers when nation-wide customer toll dialing is in effect.

Local AMA equipment associated with the No. 5 local crossbar installation at Englewood was modified to permit one- and two-party customers to dial short-haul toll calls over an extensive area and to dial long-haul toll calls to areas which are now also on a seven-digit (two-letter-five-number) local numbering plan which can

* Information brought up to date since U.S.I.T.A. talk.

be reached through the No. 4-type toll crossbar or crossbar tandem installations.

The nearby direct dialing range of Englewood customers, who recently have been able to dial all telephones in northern New Jersey and New York City, was thus extended to include telephones in Westchester, Rockland, and Nassau counties and parts of Orange and Putnam counties in New York. More impressively, these people are now able to dial direct to telephones in the following cities and many of their suburbs: Boston, Providence, Philadelphia, Pittsburgh, Cleveland, Detroit, Chicago, Milwaukee, Sacramento, Oakland, and San Francisco.

The Englewood test climaxes years of development by Bell System research and operations engineers, and the importance of the occasion was marked by ceremonies which included the dialing of a call by Mayor M. Leslie Denning of that city direct to Mayor Frank P. Osborn of Alameda, Cal.

The first customer-dialed long distance call in history spanned the nation in 18 seconds on November 10 when Mayor M. Leslie Denning of Englewood reached Mayor Frank P. Osborn of Alameda, Calif., with 10 quick pulls on a telephone dial. Telephone people, public officials and civic leaders, and newspaper men looked on

Bell Telephone Laboratories technicians spent a month dialing test calls in preparation for the inauguration of customer toll dialing in Englewood, on November 10

It is far too early, of course, to draw conclusions from the test. But Englewood customers appear to like dialing their own calls right through to distant cities—judging from their favorable comments so far.

Plans are also being made for an initial trial installation of the centralized AMA system, probably in 1953. Initially it is expected that the number of the calling telephone will be obtained by an operator and keyed into the recording mechanism. The ultimate objective, however, is automatic station identification.

Present Status of Toll Dialing

At present, about 38 per cent of the toll-board calls are dialed by operators. About half of these are short-haul toll calls between nearby points, and the other half are longer calls between toll centers.

There are step-by-step networks in various parts of the country, and most of these are now connected together through toll crossbar switching systems.

Since the planning for a major installation, such as one of the toll crossbar systems, must be started several years in advance of the service date, the first of the post-war installations of this type did not go into service until November 28, 1948. This was at New York, and a similar installation went into service at Chicago, December 12, 1948. During 1949 other installations were placed in service at Cleveland, Oakland, and Boston.

The six No. 4 systems, including Philadelphia, did not initially have all features required for nation-wide dialing, because development work could not be completed by the Bell Laboratories in time for these projects. The first installation of an improved toll crossbar system, designated Advance 4A (A4A), was placed in service at Albany, New York, in April 1950. All future units will be of this or later models.

Englewood customers inspect some of the mechanisms which make it possible for them to dial their own toll calls to 11 million telephones from Boston to San Francisco

Other A4A systems have since been placed in service at Indianapolis, Baltimore, Washington, Kansas City, Minneapolis, Pittsburgh, Atlanta, and Dallas. Each toll crossbar switching system is the focal point of a far-reaching network, as is indicated by the network associated with the Chicago system. (See chart on page 262.)

At present there are 756 toll centers equipped for dialing either into one or more of these toll crossbar systems or into toll centers having other types of dial equipment.

CUSTOMER DIALING

Customer dialing of toll calls requires mechanical recording of information for billing purposes. Several methods are in use.

Zone registration is now used in New York, Boston, Chicago, Philadelphia, San Francisco, and several communities in northern New Jersey. Automatic ticketing is in use in 19 locations centering around Los Angeles and San Francisco metropolitan areas. Automatic message accounting is now in service at 44 locations: 16 in Pennsylvania, 17 in New Jersey, four in Michigan, six in Illinois, and one in New York.

More than 400 million annual short-haul toll and multi-unit messages are now customer dialed. This is about 21 per cent of the total calls in these categories.

Problems of Co-ordination

One unique feature of both planning for nation-wide dialing and carrying out the plans is the extensive coördination required. Anything that is done in one city must be known and reflected in the plans for toll dialing at all other cities having direct circuits to that point.

For example, the Detroit 4A toll crossbar system now being engineered is expected to have circuits to every Bell Operating Company in the United States, to a number of Independent Company points, and to sev-

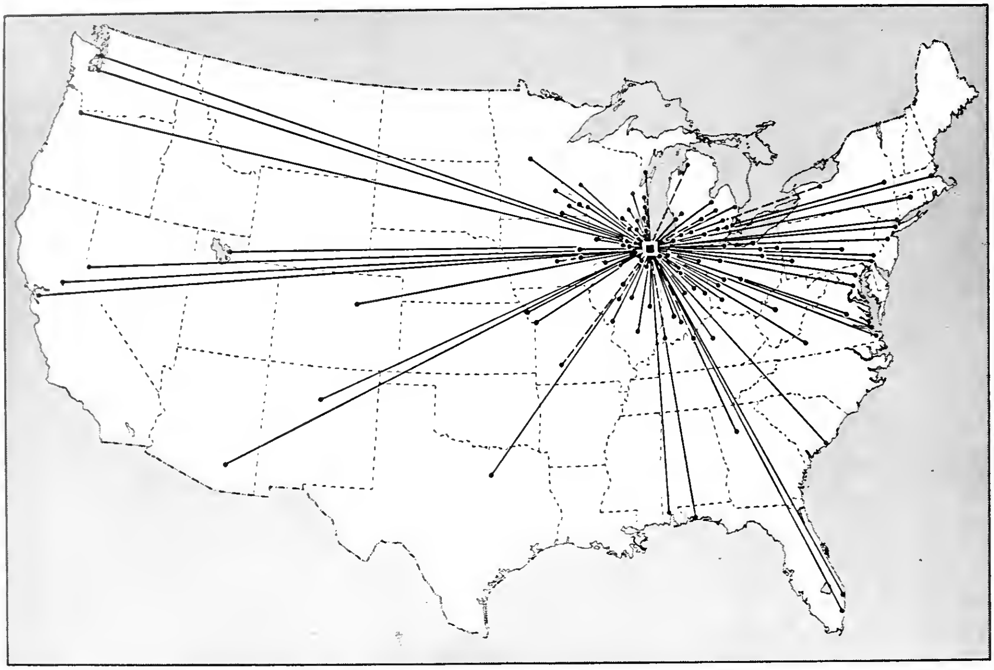


Diagram of trunk groups in service in October 1951 for toll dialing to the Chicago No. 4 toll crossbar system

eral cities in Canada. The engineering and installation of toll dial equipment at all of these outlying points must be coördinated with similar work in Detroit so that the entire network, reaching all over the two countries, will be ready for service early some Sunday morning in the latter half of 1953.

With operator toll dialing, the problem of coördination is extremely important among Engineering, Traffic, and Plant Departments and the development and manufacturing organizations. It becomes even more necessary with customer toll dialing because, in addition, the Commercial and Accounting Departments are deeply concerned. There will also be many inter-company problems involving the Independent Companies as well as the Bell Operating Companies.

Another broad consideration that calls for planning and the closest coördination is the public relations aspect.

A project of this kind presents a double-edged public relations job. We have not only the responsibility of making sure that customers understand and appreciate the operation of the service as it may affect their use of out-of-town calls, but also the opportunity to use this specific accomplishment as an illustration of the full meaning of service improvement and expansion in the telephone industry.

Furthermore, presentation of the constructive side of the story gives an opportunity to put to rest some of the potential negative aspects: for example, technological unemployment.

There are always people who raise the question of what happens to the operators when telephone service is converted to dial. Here is a good opportunity to repeat the answer which—in terms of Bell System experience—is that today there are over 240,000 employees on the traffic operating force, and that is nearly twice as many as there were on the job before we started local dial conversion back in the early '20s.

Reactions on Existing Plant

THERE ARE many indications that the existing layout of the toll plant, which is suitable for present routing methods, will not be the most advantageous layout for operation in the future. Many new features affecting toll plant design have recently come into the toll picture. Some of the more important are:

Development of the nation-wide operator toll dialing plan.

The expansion of extended-area rate treatment.

Plans for extension of customer toll dialing including use of centralized automatic message accounting (CAMA).

Need for toll dispersion in many cities.

New types of line facilities, such as cheaper short-haul carrier systems for both cable and open wire, radio relay system, a coaxial cable system with wider transmission band, and improved signaling system.

Continued rapid toll growth.

The effect of television and probably intercity networks for television programs.

In view of these many factors affecting the design of toll plant, it seems desirable to make a general review of toll fundamental planning work, taking these into account.

For example, use of the centralized AMA system in a medium-sized or large toll center, or at one point in a cluster of small toll centers, is likely to reduce the number of small toll centers which can economically be retained with widespread customer toll dialing. Also, a guide is needed in making the gradual transition from the present layout of toll circuits to the layout that would be most desirable with rapid mechanical switching and automatic alternate routing.

Studies are under way to determine the effect of these important new elements on the future layout of the nation's telephone network. It is important that there be close coöperation between Independent Companies and the Bell Companies in carrying out this work.

Summary

THE BASIC PLAN for nation-wide extension of toll dialing has been completed and is in the hands of the Bell Operating Companies. This will be under continuous review to keep it up-to-date as new developments or changing conditions require. In connection with all current Bell System projects, consideration is being given to the need to fit in with the nation-wide plan.

Existence of this plan, with provision for all Independent Companies, means that whenever it fits in with development of its own territory, any Company can join in the growing nation-wide dialing network.

On the other hand, there is no compulsion; each Company can decide when to do it or whether to do it at all. It does seem, however, that it is important from the standpoint of the industry as a whole to give very serious consideration to carrying out individual projects in a way that will permit extending the advantages of this type of operation.

It seems likely that, with continuation of the orderly conversion program followed during the past few years, the transition to nation-wide operator toll dialing under the proposed plan can be largely completed during the next decade. Since the entire plan was developed from the beginning in a way that would lend itself to the expansion of customer toll dialing, it is likely that substantial progress will also be made in this field toward the ultimate objective of enabling any customer to dial his call to another one across the continent as easily as he now dials to his neighbor across the street.

People in the telephone business have never doubted the importance of the telephone as a household necessity. Now it has legal confirmation.

In requiring a landlord to permit installation of a telephone in a tenant's apartment, a New York City judge ruled that "this relief of mental anxiety in a world already full of nervous tension can no longer be deemed a luxury or mere convenience. . . . The telephone in most areas of our country has become a necessity . . ."

And a Chicago judge, instructing the father of a teen-age girl to restore the telephone to the home from which he had ordered it removed, characterized the telephone as "an American institution." Declared the court: "Young people should have the same access to telephones as grown-ups. Parents should not object to children using the phone. It keeps them happy, at home, and out of trouble."

That seems to make it official.

Compiling, Producing, Delivering Sixty Million Copies of Bell System Telephone Directories per Year Is Huge and Highly Organized Essential Operation

Great Books from Little Listings Grow

F. Selwyn Gay and Emil B. Voelcker

THE DOORBELL rings. You answer. It's your new telephone directory. You give the carrier your old book. A seemingly simple, impersonal transaction it is—and a commonplace one. The same thing happens to your next door neighbor, at the house across the street, in fact all over town—because every telephone customer gets at least one book.

But your telephone book is not impersonal to *you*. Your name is in it—and your friends' names and your relatives' names. In fact, the first thing you do—and if you don't you should—is to look up your listing. Yes, there it is, in the right place, with the right spelling, right address, right number. It gives you a sense of satisfaction.

You may not know—and at the moment may not care—that your new book is one of 2,500 different directories published by the Bell System. Your listing is one of 35 million. Your copy is one of 60 million delivered in a year.

To say that the publishing of all these directories is a big operation would be a masterpiece of understatement. Some Hollywood adjectives are needed: *stupendous, colossal*. How it is done is quite a story. For, next to the Bible, the telephone directory is probably the most widely consulted book in America. It tells people telephone numbers they want when they know the name. It tells people "where to buy it" for practically anything they may need. In fact, telephone service without the "telephone book" is quite unthinkable.

The telephone directory has two

parts. The white pages list each customer, whether residence or business, in alphabetical order. A customer may obtain additional listings to cover members of the family, members of the firm, or alternate numbers to call after business hours. In the Yellow Pages, businesses are grouped under alphabetically arranged headings describing the many different products and services they provide. In addition to these listings, most firms use space to furnish pertinent information about their business. The Yellow Pages have achieved widespread use as a buyers' guide. They are recognized by business generally as a powerful merchandising tool.

To round off the "number-finding" service, the directories furnished to customers are supplemented by Information service. Information operators have up-to-date records of new customers and of changes in names, addresses, and telephone numbers since the last directory. They also have at hand books of nearby communities.

The operations involved in putting out a telephone book fall into four divisions: directory compilation, selling and servicing classified advertising, paper and printing, and delivery.

Directory Compilation

A HOME is built, one burns down. A couple weds, one is divorced. A new business opens, one folds up. A firm moves, one changes hands. A street is renamed, its numbers are changed.

These and multitudes of others are every-day events. But, as they surge through directory offices, each calls for prompt, accurate action. To directory people they represent changes in, additions to, and deletions from directory records.

Let's watch the work in a typical compilation office for a large city where printed Information records are used. Each day some 5,000 or more orders calling for new, changed, and deleted listings will be handled. What directory records are involved? How are they produced and how are they used?

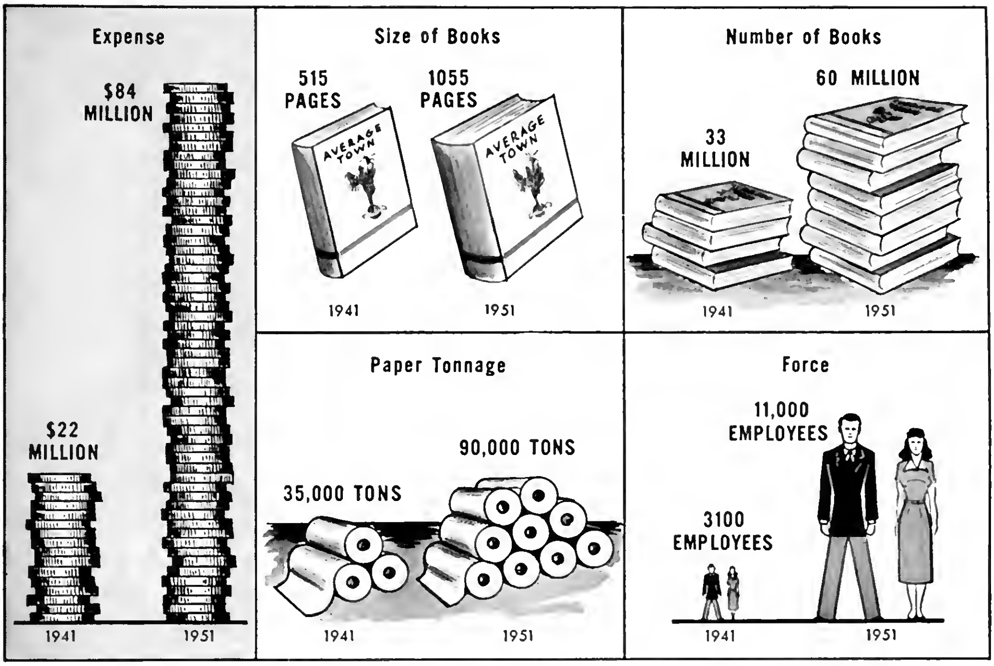
The first "must" is to keep Information records complete and up to date. The information operators in this typical city use, as their primary record, an alphabetical directory similar to your own book. However, it is completely reprinted at intervals—generally once a month.

If a listing is not found in the monthly "reprint," they turn next to an addendum printed each day. This is an alphabetical list which is built up from the new and changed listings as they accumulate between issues of the reprint. At the end of each monthly cycle, the addendum listings are worked into the reprint and a new addendum is started.

As the orders flow into the directory office, they are exposed to the keen eyes of skilled reviewers who arrange for the correction of any apparent error. Another group, directory editors, try to confine listing information to a single line wherever possible. They work toward this end by striking out extraneous information and making appropriate abbreviations. *Avenue of the Americas,* for example, would be reduced to *Av Amer.*

After reviewing and editing, the listing information is promptly arranged in alphabetical order and travels to the printer by either mes-

DIRECTORY A BIG, FAST-GROWING CONTINUING OPERATION



senger or teletype, depending upon the distances involved. Constant objectives are maximum speed and keeping compilation work up to date.

At the printers, the first operation is to set the new and changed listings into type. This is done on linotype machines, which produce strips of metal, or slugs, the width of the directory column, on which raised letters appear. These slugs are sandwiched into the daily addendum type which has accumulated since the last reprint. Like a metropolitan newspaper, the daily addendum is printed near midnight, to reflect the day's events. Around daybreak, copies with that "fresh off the press" smell are distributed by special messenger to the Information operators.

At the end of the monthly cycle, the printer has the job of working the accumulated daily addendum type slugs into the monthly reprint. He also removes the slugs for listings to be withdrawn from the reprint, and then reprints the entire record. Although the cost of frequently reprinting Information records is substantial, the money is well spent. These records speed up the work at Information, thereby improving the service and affecting economies.

HERE IS a very important point. In keeping Information records up to date, the directory people are at the same time preparing the very type used in printing the customer's directory. Errors are kept to a minimum, since all new and changed listings, just as they will appear in the customer's directory, are checked and rechecked before publication. This too promotes economy as well as accuracy.

In addition to day-to-day checks, special measures are taken when called for to improve directory accuracy. For example, certain customers may be sent printer's proofs of new or changed listings, enabling them to preview their listings and request any changes desired. Or cross checks with other Company records may be made. Recently all of the listings in several large directories were checked against the customers' service record cards in the business offices. The number of differences uncovered which could have caused mistakes fully justified the expense and time invested. One more step in lining up sights on the bullseye of perfection.

Since completed calls are the bread and butter of the telephone business, directory people shoot for 100 per cent listing accuracy. To date they haven't quite made the grade, but they're getting there. The latest issues of the alphabetical directories are 99.91% correct. To the layman, any betterment of this figure might appear an unattainable ideal. But directory people refuse to concede this. Through their vigilant efforts, even this figure is trending upward.

To the patience, accuracy, speed, and pride of accomplishment of the 6,000 compilation employees and their supervisors goes the lion's share of the credit for the millions of little listings appearing just as they should in the nation's telephone books.

Selling and Servicing Classified Advertising

Odds of more than nine to one (established through usage surveys) say that you recently used the Yellow Pages to locate something you needed. The ease and speed with which you found it were no coincidence. It resulted from joint planning by the Yellow Page advertising representatives and the business customers they interviewed. The former, about 2,500 specially trained representatives, complete over 3½ million interviews each year. Their job is to make the Yellow Pages work for you. "You" may be a buyer or a seller.

Newcomers in training for directory compilation. Thorough knowledge of the job promotes self-reliance and leads to good working habits. Ere long, any book they read will be free of errors

These girls process about 5,000 orders each day. They edit and check the listing information and prepare copy for the printer

To illustrate how the representative's work benefits both the buyer and seller, here is what is covered in a typical interview. The discussion is aimed at getting proper answers to two basic questions. First, where in the Yellow Pages will prospective buyers look for the seller when interested in the products and services he handles? Second, once they have found him, what will they want to know about him, and what should he tell them in endeavoring to get their business?

To answer the first question, the representative reviews with the business man each classified heading which might have some bearing on the firm's wares. With this approach, an electrical manufacturer would select such headings as *air conditioning units, electrical equipment, refrigerators, vacuum cleaners,* and *washing machines.* A heating contractor would select *air filters, electrical controls, furnaces, gas and oil burners, thermostats,* and *unit heaters.* A department store might select a hundred or more headings.

In passing, here is an interesting point regarding headings. Great care is taken to insure that the wording of each heading is the one most commonly used. For example, one heading might be "Mirrors," rather than "Looking Glasses." However, if enough people use the term *looking glasses,* it would appear as a cross-reference indicating that the firms handling looking glasses can be found under "Mirrors." These cross-references are likewise valuable to advertisers. They help guide business to them; they eliminate headings at which an advertiser might otherwise need additional representation.

Let's get on to answering the second question. Assume that the firm has selected the several headings where people will look for its products and services. Now the task is to develop the message at each heading which will tell them what they want to know—the message that will be action compelling.

What prospective buyers want to

Advertising representatives in an "experience meeting." Ways of increasing the value of Yellow Pages to both advertisers and users are receiving close attention

know varies considerably by lines of business and by types of things in which they have an interest. For stores going after cash and carry business, for instance, "easy to reach location" and "ample free parking" would be effective appeals. On the other hand, stores promoting telephone or mail order business would feature "charge accounts," "prompt free deliveries," and "telephone orders." Brand names are almost a must in copy for such lines as paint, batteries, bicycles and even clothing. In other lines they are less likely to be important; for example, venetian blinds, lumber, and toys.

There are even variations in the types of copy which prove effective for different services. For cleaning and storing expensive items (e.g., fur coats and oriental rugs) the prospect wants assurance of high quality work and safety of property. With towing service, on the other hand, the unfortunate stranded prospect wants to know—"Can I get it now?"

When a decision has been reached on the contents of the message, or "copy," some finishing touches are in order. Choosing words for expressing thoughts most effectively; arranging thoughts in logical order; giving most prominence to the most important thoughts; weighing the contribution "art work" could make to the attractiveness and "pulling power" of the copy.

Through these and other similar steps a layout is created as it is to appear in the Yellow Pages. Its size is largely dependent on how much the firm needs to say. The space used by a concern at a given heading can vary from a single line under a listing to a third of a page.

A firm may market its products in a single community, in several states, or on a nation-wide basis. If on the larger scale, representation in sev-

Classified Directory Does a Job in Korea

The merchant seamen's club in Seoul, Korea, can order supplies now thanks to Manhattan's big classified telephone directory.

The club's files had been destroyed by the invading communists and Edward Bartham, director of the club, faced the problem of ordering supplies with no records. He wrote to Reuben H. Donnelley Corp., directory agents for our Company, and requested a copy of the Manhattan classified directory.

"Only through your directory can we hope to recover information that is very important to us," he wrote.

The directory was shipped at once.

(From the May 1951 "Telephone Review," employee magazine of the New York Telephone Company)

eral or all directories would be needed. To meet this need many businesses use Trade Mark Service in the various books covering their respective market areas. This service enables a firm to have an inch of space under headings describing any or all of its products. This space shows the trade mark, brand name, and a brief sales or service message. Under it are listed the authorized local dealers. Many Trade Mark Service customers refer the public to the Yellow Pages for their local dealers in newspaper and magazine ads, and during radio and television programs.

It is obvious that to be fully helpful to a business firm, the Yellow Page representative must have several special qualifications. He must be thoroughly familiar with his own product—its usage, its circulation, the markets covered, and the classified headings available. He must have the ability to write interesting and informative copy; also to design attractive and well-balanced layouts. Lastly, he must have a good general knowledge of the operation of the firm he is interviewing and current marketing procedures in the industry in question.

That business establishments get results from their Yellow Page representation is evidenced by statistics. Usage survey figures show that better than 9 out of 10 people find

One of 3½ million interviews. Discussions such as these have developed the multitude of ideas which have made the Yellow Pages a powerful business builder the Yellow Pages useful as a buying guide. Over half of the Bell System's business customers are supplementing their classified listings with advertising. The number is steadily increasing, and many are advertisers of long standing. They represent a wide variety of retail, wholesale, service, industrial, and manufacturing establishments. Many smaller business concerns tell us they use no other form of advertising.

Directory Paper and Printing

"IMAGINE a belt of paper 50 feet wide and 25,000 miles long extending completely around the world at the equator!" So ran a newspaper headline about 10 years ago describing the amount of paper required in a single year to print Bell System directories. Today there would be three such belts encircling the equator.

To buy this vast quantity of paper at favorable prices, and to secure the particular kind best suited for telephone directories, transactions generally are handled on a System-wide basis rather than by individual Bell Companies. For many years, this undertaking has been centralized in the Purchasing Division of the Western Electric Company—the System's manufacturing and supply organization.

Western Electric people have acquired an intimate knowledge of the kind, quality, and amount of paper that various mills can produce. They work with the paper mills toward further improvement in the quality of paper and greater efficiency in production.

Directory paper in storage. A roll measures 36 inches in diameter, 60 inches in length, and weighs almost a ton

To control the quality of paper purchased, Western maintains a fully equipped testing laboratory. Here, paper samples are tested for conformity with specifications prepared by A. T. & T. engineers, which include requirements for weight, thickness, strength, opacity, and fiber content. Telephone directory paper must permit clean, clear printing on both sides of each sheet without show-through. It must be light in weight so that books aren't too bulky. At

Automatic equipment for gathering, binding, and covering telephone directories

the same time, it must be able to withstand the strain of high speed presses and constant usage by the public.

The directory printing and binding job is a highly specialized one in the printing industry. Size of page, speed of printing, and large volumes to be handled limit the number of printers qualified to handle the really large directories. The cost of necessary special equipment alone can run into millions of dollars. For a printer to make such a substantial investment, he must have assurance of enough directory printing business from year to year to make it "pay."

Here again Western, through nation-wide operations, performs a service in coöperation with A. T. & T. engineers which could not be matched economically by any single Bell Company. Printers have been encouraged to expand and improve their facilities. As a result, some 40 of them are now qualified to print the larger books. They are strategically located to minimize distances between printer, directory office, and delivery point—an important factor in over-all production time and costs. Printing contracts are, of course, awarded on a competitive basis, and run for about five years.

Western Electric people work with individual printers, encouraging improvement in method aimed at better quality and lower cost. Once such an improvement is developed and has been thoroughly tested, Western takes the necessary steps to extend its benefits to all printers handling Bell books.

The end result is a printing operation of a magnitude and speed almost impossible to describe: presses printing more than 1,500,000 pages per hour each; automatic pasters joining one roll of paper to another for uninterrupted printing; combined gathering, binding, and covering equipment turning out more than 90,000 books a day. It is a notable achievement, made possible through precisely integrated operations.

The need for maximum speed, efficiency and economy is paramount. Even after fully capitalizing on all possibilities for controlling cost, the combined paper and printing bills for Bell System directories run to more than $40,000,000 a year.

Delivery of Directories

This is a one-time operation: a highly concentrated, swift-moving job lasting two or three weeks for the largest books and only a day or so for the smallest ones. So, each time a new directory is published, such aspects of the operation as hiring and training carriers and renting delivery stations must start from scratch. Deliveries are, therefore, generally handled by outside distributors working under contract with the various Bell Companies.

The first requisite of good delivery is accurate and complete delivery records. Their maintainance is a continuing operation handled by directory people. The records must insure that each customer receives the kind and number of directories he needs—no more, no less. Otherwise, the result is likely to be dissatisfied customers and unnecessary expense which, if not detected, may continue year after year. Therefore, except in very small places, each customer's directory needs are settled with him when he first applies for telephone service, and then are reviewed from time to time.

Delivery methods vary. In downtown business sections where deliveries are concentrated, the carriers work directly from large motor trucks with hand carts and bags. In residential areas the men, after receiving their route assignments and supply of books at the delivery station, use their own cars in making deliveries. In sparsely populated sections, books are mailed.

It is desirable, of course, to get the old directories, with their obsolete information, out of circulation when the new ones are delivered. Also, the salvage of old books produces worth-while revenue. They are used by paper mills to produce new paper, cartons, and even the covers of book matches. So carriers are paid not only for each book delivered but also for each old book picked up.

The distributor's work is carefully checked by directory employees. Telephone calls, for instance, are made to customers who do not return their old books, to make sure that they actually received their new ones.

Sometimes old man weather puts in some of his nastiest licks right when a delivery is scheduled. In Chicago in December of 1950, a heavy snowfall with extremely low temperatures almost paralyzed the delivery. The emergency was met, however, by increasing the size of the force through extensive newspaper advertising and paying the men weather bonuses. The delivery was completed only a few days behind schedule.

THIS IS, briefly, the story that lies unwritten between the covers of your telephone directory. Like the history of telephone service itself, it is one of progressive changes and improvements from the beginning to the present. "The Spirit of Communication," the figure shown on the front covers of Bell System directories, is symbolic of the motives and efforts of the directory people: to make the directories ever more useful to the users of the service.

Twenty-five Years Ago in the

BELL TELEPHONE QUARTERLY

Items from Volume VI, Number One, January 1927

Bust of Bell Is Presented to Smithsonian Institution

A BUST of the telephone's inventor, Alexander Graham Bell, the work of the sculptor Victor Salvatore, was presented by the American Telephone and Telegraph Company to the Smithsonian Institution in Washington, D. C., on December 9, 1926, at the annual meeting of the Regents of the Institution.

Every member of the Board was present for the ceremony. Chief Justice William H. Taft, Chancellor of the Board of Regents, presided, and around the table sat Vice-President Charles G. Dawes, U. S. Senators Reed Smoot, George Wharton Pepper, and Woodbridge N. Ferris; Representatives Albert Johnson, R. Watson Moore, and Walter H. Newton; Hon. Henry White, Hon. Irwin B. Laughlin, Charles F. Choate, Jr., Robert S. Brookings, Frederick A. Deland, and Dwight W. Morrow. The Secretary of the Smithsonian, Dr. Charles D. Walcott, also was present. Mrs. Gilbert Grosvenor, a daughter of Alexander Graham Bell, unveiled the bust.

Chicago-St. Louis Cable Opened

JOINT ceremonies in New York, Chicago and St. Louis on December 15 inaugurated the newly-completed long distance cable link between Chicago and St. Louis, insuring for the future the best posble storm-protection for communication through from New York to St. Louis as well as between intermediate points.

From the New York end, President Gifford of the American Telephone and Telegraph Company and President McCulloh of the New York Telephone Company exchanged greetings with President Nims of the Southwestern Bell Telephone

Company and President Abbott of the Illinois Bell Telephone Company in their respective headquarters. Mr. James Brown, chairman of the executive committee of the Chamber of Commerce of the State of New York, opened the commercial service with congratulations to the heads of similar bodies in St. Louis and Chicago.

The new link, 344 miles in length, requiring two years to construct and an expenditure of $7,000,000, is an extension of the New York-Chicago long distance cable completed in August, 1925. It will provide more than 250 telephone circuits, and more than 500 telegraph messages can also be sent simultaneously, making it the equivalent of ten heavily loaded pole lines of open wire.

Bell System Wins "Sesqui" Grand Prize

"In recognition of the epoch-making development and the continual improvement of a nation-wide means of direct communication unified by the Bell System."

THIS is the citation that accompanies the grand prize award to the American Telephone and Telegraph Company and Associated Companies, as recently announced by the International Jury of Awards of the Sesquicentennial International Exposition.

Thus history repeats itself and the city which saw the first award of merit to the infant invention of Bell is the scene, fifty years later, of another signal honor for the telephone.

The exhibit of the System upon which the award was based consisted of a building erected by the American Company in the Palace of Liberal Arts No. 1. In the entrance was displayed a duplicate of the primitive telephone apparatus exhibited by Bell at the Centennial Exposition in 1876. It was the original of this instrument that received the first award of merit given to the telephone by a Board of Judges including the leading scientists of Great Britain and the United States, Sir William Thompson and Prof. Joseph Henry. The former prophesied in making his report on awards, "We may confidently expect that Mr. Bell will give us a means of making the voice and spoken words audible through the electric wire to an ear hundreds of miles distant." Suggesting the fulfillment of this prophesy was the display at the exhibit of a modern central office with miniature operators at their positions and other details perfectly reproduced in wood and clay, representing the system of today that inter-connects over 17 million telephones.

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